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Edited by
J. A. MALLETT

Articles which appear in the "Journal" may be reprinted, provided that the "Journal" and the authors are acknowledged.

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COVER PICTURE

Melaleuca scabra, sometimes known as "Warru" bush" is an attractive shrub which grows to about 3ft. in height and bears a profusion of pinkish-purple flowers. It is a member of the tea-tree family and is found in gravelly and sandy soils from Watheroo in the north, eastward as far as Merredin and southward to Israelite Bay.

IN THIS ISSUE

	Page
The Home Tanning of Hides and Skins .... J. A. Mallett	5
Organised Drives Will Control Foxes J. S. Crawford and A. G. Veitch	11
Book Review—Stud Cattle in Australia	14
Copper Poisoning in Sheep .... H. W. Bennetts	17
Weed Control in Peas .... G. A. Pearce	21
Pink Wax Scale .... C. F. H. Jenkins	25
The Cultivation of Lettuce .... W. H. Kooyman	29
Spear Thistle .... G. W. R. Meadly	33
Silage Competition 1957-58 .... H. G. Elliott	37
Flax as a Rotation Crop in the Higher Rainfall Areas of W.A. .... H. G. Elliott and F. E. Ryan	45
The Rabbit Population in W.A. .... A. R. Tominlson	51
Farm and Home—Some On-the-Spot Ideas .... Brenda Cleeve	55
Pink-Eye in Cattle .... C. R. Toop	61
Dry-Pickling Seed Wheat .... W. P. Cass Smith	63
Mineral Supplements for Kimberley Cattle .... W. M. Nunn	65
Mineral Supplements for Stock in Pastoral Areas L. C. Snook	71
Linen Flax in Western Australia .... H. G. Elliott	77
The Storage of the Granny Smith Apple .... F. Melville	91
Recent Rural Radio Talks	97
List of Registered Fertilisers 1958-59 .... H. G. Cariss	117

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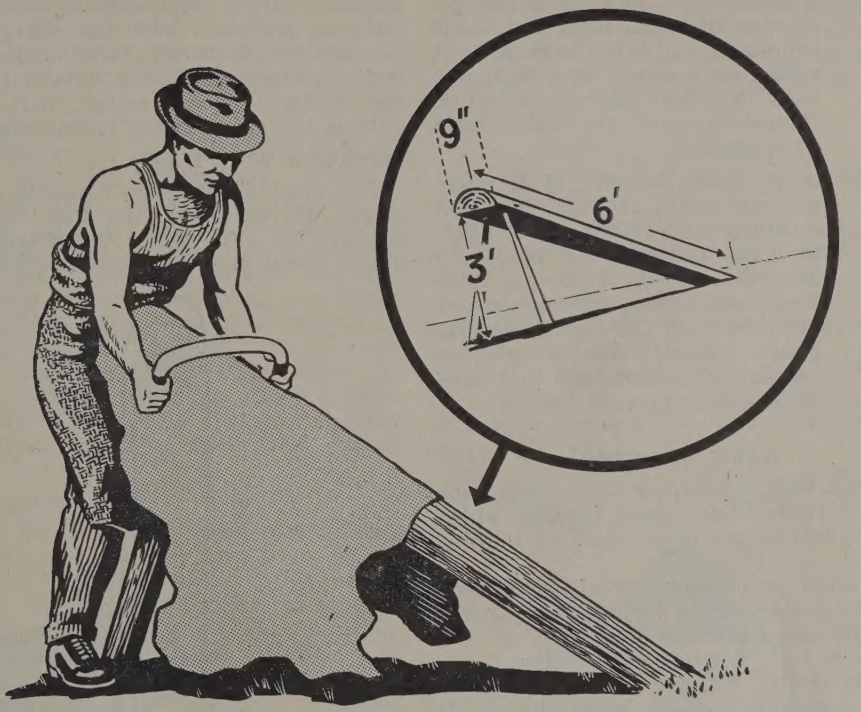


Fig. 1.—A "tanner's horse" can be improvised as shown. The wet hide or skin is draped over the horse and the operator—wearing bagging or other material as an apron—leans against the end of the horse and scrapes the flesh side of the skin. Strokes of the scraper should be made towards the lower end of the the horse

THE HOME TANNING OF HIDES AND SKINS

By J. A. MALLETT

INQUIRIES are frequently received from farmers concerning methods of home tanning, and while this subject is outside the scope of normal departmental advice, we are publishing a number of recipes from various sources which may be helpful.

It has often been said that the soundest advice to those contemplating home tanning is identical with Mr. Punch's oft-quoted advice to a young man contemplating matrimony. Mr. Punch's advice was "Don't"—and unless the amateur tanner is prepared to devote plenty of time and put in a lot of work on the tanning project, he would be well-advised to hand the job over to a professional tanner if he can find one willing to undertake custom work.

DE-HAIRING

Hides and skins may be tanned with or without hair or wool. If it is desired to remove the hair, the hide may be dehaired by one of these methods:—

(1) The hide—if dried—is soaked in water until pliable. Newly-flayed hides do not require to be soaked. Fold the hide with the hair inward to form an easily-handled package and bury in moist earth or sand, or in a manure-heap. Exhume after two days and test. The hair on the belly portion is usually the most firmly attached. When this commences to "slip" freely, scrape the hide to remove the hair and wash thoroughly.

(2) Immerse the hide in a sloppy mixture of wheat bran and water rubbing it well into the hair. Fold with hair inward, cover with wet bags to keep moist, and test frequently until the hair comes away freely.

(3) Slake builder's lime (½ lb. lime to each gallon of water used) in a suitable tub. When the solution is cool, immerse the hide and leave it to soak until the hair comes away freely. Scrape off the hair and soak the hide in several clean waters. Use a vinegar solution (1 pint vinegar to 3 pints water) to neutralise the lime.

BARK TANNING

Many West Australian trees have bark with a fairly high tannin content which lends itself to the preparation of tanning liquor.

To each gallon of water allow approximately these weights of dried bark broken up into small pieces:—

Mallet 1 lb.; Wattle 1½ lb.; mallee 2½ lb.; gimlet 1½ lb.; wandoo 2 lb.; jam 5 lb. Bark which is stripped when the sap is up and dried in the shade is best. Green bark contains a lot of water and is not so easily broken up.

Iron should never be allowed to come into contact with tanning bark or liquor as it combines with the tannin to cause unsightly stains. It is advisable to pound up the bark with a mallet or maul and to use wooden tubs as tanning vessels.

Soak the shredded bark in rainwater for several days, then draw off the liquid. One gallon of this stock solution should be diluted with two gallons of rainwater to make the initial tanning liquor. Some people recommend pouring boiling water on the shredded bark to extract more tannin.

Preparing the Skins.

Before placing the skins in the tanning liquor, remove all flesh, fat and surface layers from the flesh side of the skins. This is best accomplished by laying the wet skin over a beam or "tanner's horse" (see illustration) and using blunt knives, rasps, files, scrapers, brickbats, or pieces of broken grindstone to remove unwanted material. Use a soap solution with washing soda added to wash the skin free of fat and grease before tanning, particularly if tanning with the wool or hair on the skins. Rinse free of soap before putting the skins in the tanning liquor.

Start with Weak Liquor.

The first tanning liquor should be the colour of very weak tea and the skins should be immersed completely and moved about each day to ensure that the liquid reaches every part. It is advisable to take the skins out of the liquor fairly frequently and treat them by scraping the flesh side, using the "horse" and a blunt drawing knife. A cut made in the edge of the skin will reveal the extent of the penetration of the tan liquor.

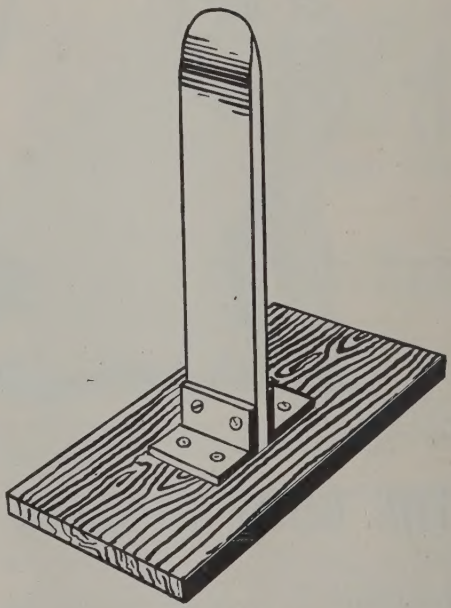


Fig. 2.—A "staking tool." This could be made from hardwood or metal. An old blunt axe-blade set in a vice makes a good staking tool

An insufficiently tanned skin will show a white "horny" streak in the centre of the cut edge.

White patches on the flesh side of the skin will indicate that the liquor is not penetrating those areas, probably due to excess fat in the fibres. Such patches should be given extra scraping.

The tanning liquor will weaken as the tannin is absorbed into the skins. As this occurs, the old liquor should be drained off and replaced with a fresh solution, or it could be "topped up" by the addition of a quantity of the stock solution.

The time required to tan a skin depends on the thickness and texture. Bullock hides may need up to four months or more to give best results, although for home and farm use they would probably be satisfactory so long as the tan had completely penetrated through the fibres.

The golden rule in successful tanning is to "make haste slowly" using weak liquors especially in the early stages. At a later stage a somewhat stronger solution may be used, but always remember that strong solutions make the leather hard.

Fat-Liquoring.

When the skins are sufficiently tanned, they should be taken out, well washed with soap and water and scraped on the "horse." They should be placed to dry in a shady spot, and while still wet, the flesh side should be treated with an emulsion of oil, soft soap, egg yolk, etc.

A Perth tanner recommends dissolving ½ oz. of washing soda in a small quantity of water and whisking this with two egg yolks into a pint of castor oil.

Sulphonated cod oil or neatsfoot oil is recommended by other experts while a successful amateur tanner recommends equal quantities of neatsfoot oil, soft soap and methylated spirit. The oil is heated almost to boiling point, then removed from the fire and the soft soap and methylated spirit are stirred in separately. The mixture is applied warm.

These emulsions should be applied to the wet skins, being scrubbed into the flesh side with a stiff brush.

Staking.

At frequent intervals, the drying skin should be worked between the hands and "staked" by drawing it backward and forward across a blunt axe-blade or similar tool. Thorough staking, together with the penetration of the emulsion, gives the leather softness and pliability. In staking, use all the pressure the skin will stand and be prepared to put in a lot of time if you wish the leather to be soft. If on drying out, the leather is too hard, wrap the skin in a wet bag, leave overnight so that the moisture can penetrate, then scrub in some more emulsion and continue with the staking.

REDGUM TANNING

The most skilful amateur tanner I have ever known, lived in one of our South-West timber townships and he always used kino—the gum from the marri or redgum (*Eucalyptus calophylla*) instead of bark, when making his tanning liquor. His work was mainly with kangaroo and rabbit skins.

Boil a large double handful of the gum in two gallons of rainwater until all stickiness disappears. Use a copper or enamelled vessel.

Add a further two gallons of rainwater then strain the liquid through hessian into a wooden vessel.

Fig. 3.—Staking. The skin or hide is drawn backward and forward over the edge of the staking tool to loosen the fibres and make the leather pliable

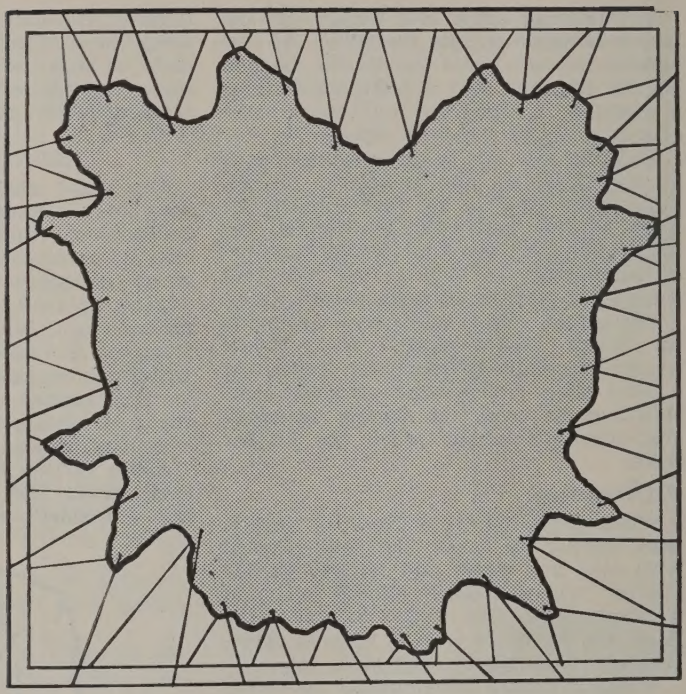


Fig. 4.—A frame, as shown, facilitates tawing as the skin sags in the centre forming a shallow receptacle which holds the alum and salt solution

After the skins have been in the tan for eight to ten days, boil up the liquid again with half the quantity of fresh gum. Strain as before and allow to become cold before replacing the skins.

Skins usually take about a month to tan but come to no harm if left longer—even up to two months.

When finally removed from the tan they should be washed with soap and water, rinsed thoroughly and tacked on a board, flesh side upward, in a shady spot. To make soft skins to be sewn together for rugs, remove the tacks when the skins are dry, lay fur side down on a flat surface and sandpaper the flesh side carefully. Damp down the skins and apply the neatsfoot oil, soft soap and methylated spirit emulsion then continue rubbing and staking until the skins are dry and soft.

TANNING NETS

Tennis nets, fishing nets, etc., can be satisfactorily tanned in either the bark or redgum solutions. A somewhat stronger liquor than that normally used for skins is permissible here, the aim being to give the finished net a dark brown colour.

Submerge the nets completely for 48 hours or more. If, on drying, the nets still appear light-coloured, repeat the process.

TAWING

Tawing is the term generally used to denote the preparation of white leather. Alum and saltpetre or alum and salt are commonly used in this work, but several other preparations give good results.

Tawing is a popular home method and is commonly used in making floor rugs from fox and kangaroo skins and woolly sheepskins.

Tawing Woolly Sheepskins.

Fresh skins are preferable for this work as the wool is less likely to "slip" than on skins which have been stored. Where dried skins are used, they should first be soaked or draped with wet bags until soft. This should be done in a cool building

away from sunlight as heating of the skin, combined with moisture, will loosen the wool.

Place across a round beam or "tanner's horse" and scrape to remove all fat and flesh from the inner side of the skin, then wash thoroughly in cold or barely lukewarm water to which has been added some good soap flakes or household detergent.

Now tack the skin out wool downward on a flat board—or better still pass cords through holes made near the edges of the skin and lace it into a frame as shown in the illustration. The frame is preferred, as the skin sags and forms a shallow container which holds the tanning solution.

Dissolve 2 lb. of alum in 2 pints hot water. Dissolve 3 oz. washing soda in a quarter-pint of hot water and add this slowly to the alum solution. This should be done carefully as a strong effervescence will be produced. Finally add 1 lb. of coarse salt to the mixture and stir till dissolved. Keep the solution in glass bottles as it corrodes metal containers.

Pour some of the solution on to the skin and scrub it in with a stiff brush. Repeat the process as often as possible every day for seven days. Let some of the solution remain in the depression of the skin and scrub it into all the higher portions. Frequent scraping or rubbing with a piece of brick or grindstone will assist penetration.

At the end of a week, drain off surplus solution and leave the skin on the frame or board for a month so that the solution can continue to act on the skin fibres. At the end of this period, the skin will be hard and stiff and coated with crystals. Wipe off the crystals with a wet cloth and swab the skin with a fat-liquor made by whisking up two egg-yolks (separated from the whites) in a cupful of lukewarm water. (Any of the other fat-liquor preparations mentioned earlier in this article could probably be substituted if desired.)

After rubbing well with the fat-liquor, the skin should be removed from the frame or board, damped down sufficiently to be rolled up, and kept moist rolled in a damp bag for about a week to allow the fat-liquor to penetrate.

It should then be thoroughly "staked" as described earlier, together with sandpapering of the flesh side and the application of more fat-liquor if required.

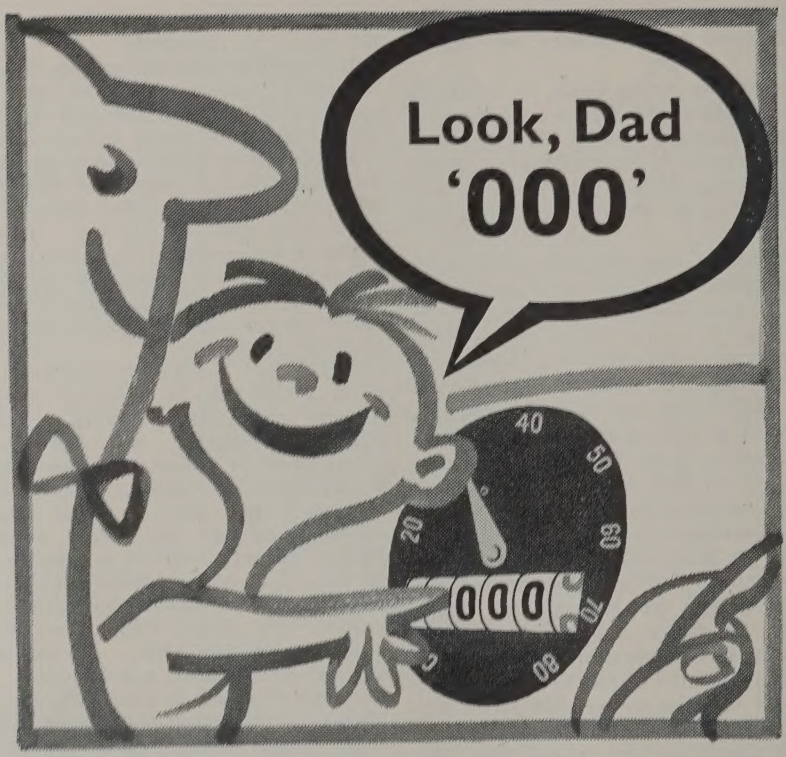
Where a skin exudes large quantities of natural grease, a paste of whiting and water should be applied thickly to the flesh side, and left to dry. It is then removed by scraping and brushing. The treatment may be repeated if necessary.

Fox-skins, kangaroo-skins or rabbit-skins can be treated in a similar manner to sheep-skins.

The great secret of making a soft alum leather is in working it up well during and after drying. For this purpose a staking tool can be made of a piece of metal (or perhaps hardwood) with a curved, blunt edge. An old axe head with a blunt edge and rounded corners will serve quite well. Mount the axe head in a wooden frame, or grip it in a vice. The top of the axe blade should be about three feet from the ground. To soften them, the skins are pulled over this edge. A considerable amount of pressure can be used. If the skins are damped on the flesh side with a little water to soften them, they will stake very much more easily. Very little moisture is needed for the purpose, and some preliminary softening can be given by working with the hands.

Unless the loose tissue has been scraped off well before tanning, the staking will raise the flesh side. If the loose flesh has not been removed before tanning, this can be done now by rubbing with pumice-stone or by gently pressing the skin to a quick-moving grindstone. A better method than the former, and safer than the latter, is to throw the skin over a pole and scrape it with a round tin lid (the lid of a tobacco tin will serve, but a larger one will work the skins more quickly). Scraping must be done with judgment.

The skins should now be soft, and the flesh side fairly smooth. The wool can be combed, brushed and, as a final finish, a narrow strip can be cut from all round the skin, since the edges are often difficult to soften. When mats of this nature are washed they sometimes dry hard. A little staking always softens them.



When your speedo says '000', your car needs

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SHELL

THE SHELL COMPANY OF AUSTRALIA LTD. AL584D

Organised Drives Will Control Foxes . . .

By J. S. CRAWFORD, Assistant Chief Vermin Control Officer, and
A. G. VEITCH, Supervising Vermin Control Officer

UNTIL 1916, there were no foxes known to exist in Western Australia. One was reported as having been seen at Esperance in that year and there are records of a fox being shot at Sandstone in 1917. Within a few years of the first recordings, foxes had spread almost throughout the State, and although bonuses have been paid on over 893,000 fox scalps during the past 30 years, we still have a large and thriving fox population which takes a heavy annual toll of young lambs and poultry besides contributing to insect damage of crops and pastures by the destruction of insectivorous birds.

Foxes have been declared vermin throughout the State and despite large sums paid out in scalp bonuses—sums ranging from £3 to 2s. 6d. per scalp—the scalps submitted increased to a record total of 50,000 a few years ago. Numbers declined when the rabbits were reduced but there is still a formidable fox population.

Foxes are not difficult to destroy. They are greedy creatures and gulp down an amazing variety of foodstuffs ranging from beetles to seaweed, so that poisoning is a fairly simple matter. Shooting, aided by decoy whistles and spotlights, hunting with dogs, trapping and poisoning account for thousands of foxes every year, yet the fox population continues to increase.

Why does this happen? The vixen usually breeds only one litter a year with an average of five cubs to the litter, so we are not faced with the almost astronomical multiplication potential of the rabbit.

The answer seems to be that our fox destruction campaigns have invariably been piecemeal affairs. One landowner or one small group of landowners will do really good work and wipe out most of the foxes in a small area, but meanwhile the pests are breeding unchecked all around the area and the relief is only temporary.

ORGANISED DRIVES ESSENTIAL

The effectiveness of wholesale baiting—not of single farms but of large areas—has been proved many times by large-scale fox-poisoning drives organised by officers of the Agriculture Protection Board. So effective were these organised drives that the Board has been inundated with requests for similar campaigns to be instituted in other districts.

Unfortunately the season at which the fox drives are most likely to be successful is the period during which many of the A.P.B. personnel are busily engaged on the "1080" rabbit control drives. Consequently it is seldom that officers are available for organising work, although local Group and Regional Vermin Control Officers assist wherever possible, particularly on the instructional side.

Groups of farmers, road boards, Farmers Union branches, Junior Farmer clubs, progress associations and other bodies could organise systematic, whole-

sale baiting campaigns throughout their districts. All farmers should thoroughly bait their own properties at the same time, and the A.P.B. will carry out a simultaneous baiting of as many adjacent Crown lands and reserves as the available poisoning units and staffs can cover. In areas where this method was employed in 1958, lamb losses were negligible and individual farmers reported highly effective kills. In districts where incomplete co-operation was received, lamb losses continued despite conscientious baiting by a few farmers.

STRYCHNINE

Strychnine gives excellent results in fox and wild dog poisoning. It is commonly available as tablets, crystals or powder—and may be in the soluble or insoluble (alkaloid) form.

Strychnine Alkaloid is practically insoluble in water and may be obtained in half-grain tablets, as pink or white crystals, or as a pink or white powder. Half a grain is a lethal dose for a fox or wild dog.

Soluble Strychnine has been treated with acid to make it water-soluble. It is always sold as a white or pink powder. Because of the additives, it is less poisonous—bulk for bulk—than the insoluble strychnine, and three-quarters of a grain is recommended as the lethal dose.

Soluble strychnine is suitable for use with fatty baits, but when inserted in lean meat or other moist baits, the dissolved strychnine often permeates the bait making it bitter and unattractive.

Tablets Preferred.

Because of the ease of handling and the pre-measured doses, the half-grain tablets are strongly recommended for large-scale bait-making. By using some instrument such as a small sharp screwdriver to make a hole in the bait, it is a simple matter to insert a tablet in the centre and close the hole by pressure of the fingers.

Measuring the dosage of crystals or powder is largely a matter of guesswork—as much as will thinly cover a three-penny-piece or half an inch of the small blade of a pocket-knife, is the usual measure of half a grain.

Spillage of crystals or powder is almost unavoidable and—apart from wastage—this often results in some of the strychnine adhering to the outside of the bait where its bitter flavour may cause the fox to drop the bait.

Obtaining Supplies.

Strychnine in its various forms, also ready-prepared baits containing half-grain tablets of strychnine may be obtained through the local Road Boards or Vermin Boards at cost price.

A local firm prepares baits made from suet, and Eastern States manufacturers put up a similar line made from brisket fat. These prepared baits are individually wrapped in paper and are convenient to handle and distribute.

PREPARING BAITS

The ideal bait is one that is attractive to foxes mainly by reason of its odour. It should be small in size so that it can be gulped down readily. A bait that has to be chewed will be rejected if the bitter flavour of strychnine is detected.

The bait should be made unattractive to ants, if possible, as ants swarming on a bait make it unattractive to foxes. Field experience has shown that whale oil, which is attractive to foxes will often repel ants.

As previously stated, foxes will eat almost anything so that a wide variety of baits may be used. Fatty substances such as suet, caul fat, dripping, butter or brisket fat are particularly popular and lend themselves easily to large-scale bait manufacturing.

Meat should preferably be cooked as this makes it firmer and dryer and easy to handle. Cooked corned beef cut into ¾ in. cubes, whale meat, beef, mutton, liver, kidneys, eggs, sardines, small birds, the heads of poultry killed for the table—all have given good results. Where wild camels exist on pastoral properties, the fat from their humps is widely used for fox and wild dog baits as it cuts up into neat cubes.

Where the material is firm enough to be cut into ½ in. or ¾ in. cubes, it is a simple matter to make a hole with a sharpened screw-driver and insert a half-grain strychnine tablet.

Suet, dripping and similar materials should be previously scorched if possible

and then softened—but not melted—and mashed into a paste. Cut a number of 4 in. squares of toilet paper or apple wrapping paper, place a teaspoonful of the paste on the paper which is held cupped in the hand. Flatten the paste and insert the strychnine tablet, or the required quantity of crystals or powder in the centre, then roll the paste into a pellet enclosed in the paper.

About 100 baits can be made from 1 lb. of fat or dripping. When preparing bulk quantities, the paper-wrapped baits are placed in a bucket and sprinkled with a little whale oil. The baits should be turned over occasionally until all the papers are impregnated with the oil.

WHEN TO LAY BAITS

The obvious time to lay baits is whenever the foxes are plentiful and preferably before they are likely to kill young lambs.

For most people in the agricultural areas, the best time would be during February, March and April. At this time, when natural food is scarce and surface waters limited, the foxes tend to move into the settled areas and they are there in force when lambing commences. Plan your concerted drives during the most suitable period and follow this up where necessary with a heavy baiting around the lambing paddocks just prior to the drop.

HOW AND WHERE TO BAIT

In selecting the best places to lay the baits, one must be guided to a large extent by tracks and other signs of the presence of foxes. Well-defined travel areas such as sandy creeks and gullies, waterways cutting through paddocks, old tracks and sheep pads are often used by foxes which like soft ground and smooth surfaces.

Baits should be placed in the vicinity of outback water-points such as mills, dams or soaks. Carcasses in paddocks should be poisoned by inserting strychnine in deep slanting cuts especially in the tongue, liver or butt of the tail. Baits should also be dropped round the carcass.

It is a good idea to establish a "depot" at some outlying part of the farm where carcasses, bones, offal, etc., can be dumped to establish a regular feeding-place for foxes. When foxes are using the depot regularly, a few baits will obtain good kills.

Baits should be laid on a scent trail made by dragging a sheep's paunch or other offal, or a carcass (sheep, kangaroo or emu) that has been scorched over a fire. It is a good idea to attach a tyne to the vehicle so that it scratches a shallow furrow in which the baits can be buried just below the surface of the loosened soil. This tends to reduce the risk of domesticated dogs picking up the baits and also prevents the baits from being taken away by crows and magpies. If whale oil has been added as previously described, it will soak through to the surface of the soil and foxes will scratch out the baits quite readily.

Baits should be dropped at five to ten yard intervals, using more or less according to the estimated degree of fox infestation.

GENERAL INFORMATION

Sodium fluoroacetate better known as "1080" has been approved for rabbit poisoning by the Department of Public Health but is not available for other types of vermin at the present time. Strychnine, used as described in this article will give good results. The main point is to keep the outside of the baits free from strychnine and to keep the baits small.

Do not expect to find dead foxes on the trails. While a few foxes may die near the trails, the majority will travel some distance before the bait takes effect. An animal which takes a bait on an empty stomach will usually die very soon after swallowing the bait, but where the stomach contains other food, death may be delayed until the fox has travelled some miles from the trail.

Fatty baits usually take longer to digest than raw or cooked meats. Strychnine tablets, probably because of the binding material used, usually take longer to act than the powders or crystals, but whatever form of poison is used, half a grain of the strychnine alkaloid or three-quarters of a grain of the soluble strychnine is sufficient to kill the animal.

Strychnine is a deadly poison. Never forget this fact. Take every precaution

to prevent children and domestic animals from having access to the poison or the baits.

In case of accidental poisoning of humans or animals, the first step should be to induce vomiting by giving emetics. A dessertspoonful of mustard or two tablespoonfuls of salt in a cup of warm water are suitable household emetics, and the rather crude method of poking a finger down the patient's throat should not be neglected. A crystal of washing soda, about the size of a little fingernail will usually induce vomiting if swallowed.

Medical or veterinary attention should of course be obtained as soon as possible.

A common "bush" method of inducing vomiting in dogs is to push a wad of chewed-up tobacco down the animal's throat.

Scalp Bonuses. The uniform scalp bonus of 4s. per scalp was discontinued on December 31, 1958, and the money saved is to be expended on increasing the Agriculture Protection Board's fox-poisoning units from two to six. These units are not available for work on private properties but confine their activities to Crown lands and reserves. The success of the initial units has fully warranted their extension.

Aerial Baiting. Aerial baiting is carried out periodically over the fox-infested coastal strips within the Road Board districts of Ashburton, Roebourne and Port Hedland. Thousands of baits have been dropped in these areas with outstanding success.

Remember that the fox menace lends itself to successful control by organised large-scale baiting drives. Why let foxes reduce your profits when a concerted effort can reduce the fox population to negligible proportions.

Book Review

"STUD CATTLE IN AUSTRALIA"

"Stud Cattle In Australia" fills a unique place in the recorded history of dairy cattle breeding in Australia. Mr. P. G. Hampshire or "P. G." as he is widely known, one-time Superintendent of Dairying in Western Australia, is well qualified by his experience to tell this story.

His contacts in all States with many of the early breeders as well as with those still interested, have enabled him to write at a level which could be matched by only very few.

Intertwined in the sundry recollections there are recorded various incidents which are of very great interest and many with a special value.

The book contains excellent descriptions of the breeds and a background of their early history in Australia. To Western Australians the references to our own early stud masters are of particular interest.

The book also contains many other interesting discussions such as herd and progeny testing, exhibiting in Shows, and a large series of plates of outstanding animals of the breeds. The quality of reproduction of some of his plates however, leaves a lot to be desired.—M. C.

("Stud Cattle in Australia" by P. G. Hampshire, Price 37s. 6d. from the publishers, Beatty Bros., Perth.)

Copper Poisoning in Sheep

By H. W. BENNETTS, D.V.Sc., Principal, Animal Health and Nutrition Laboratory

(A broadcast talk given on the A.B.C. Country Hour.)

ANIMALS must have small amounts of copper for a number of normal bodily functions, including growth and blood formation and, in the sheep, wool quality. The liver is used as a "bank" or store-house for copper which is collected from the diet and in due course issued to the body tissues as required. The sheep—in contrast to other species of animals—is apt to play the miser and hoard unnecessary amounts.

Under certain circumstances the copper content of the sheep's liver builds up to dangerously high levels. A fatal poisoning may then occur following a sudden release of copper from the liver. This results in blood destruction and jaundice or "yellows."

Chronic copper poisoning or toxaemic jaundice has been responsible for serious sheep mortalities in Victoria and New South Wales, where intensive investigations have elucidated the causes and nature of the disease. The problem is not nearly so serious in this State but outbreaks have occurred here from time to time, and for many years.

Let's now consider the factors which may lead to the storage of excessive amounts of copper in the sheep's liver; the conditions determining the sudden release of this copper; the symptoms and post-mortem appearances seen in poisoned sheep; and finally the means of preventing or controlling mortalities.

COPPER STORAGE

The normal copper content of the sheep's liver is 100 to 500 parts per million. Dangerous copper levels of the order of 1,000 to 3,000 parts per million may occur under the following circumstances:— **Firstly,** with a high intake of copper, **secondly,** with a normal copper intake but with the presence of certain components in the diet which promote or "condition" excessive copper storage, or **thirdly,** as a sequel to liver damage from certain poisonous plants.

An excessive intake and storage of copper may occur in areas where pastures or herbage naturally have a high copper content due to the nature of the soil or to other environmental causes. In this State such areas are very restricted. On a number of occasions, however, poisoning has resulted from excessive supplementation with copper.

Secondly, excessive copper storage may occur even when the diet of the sheep only contains normal amounts of copper. This happens when the diet is low in molybdenum and sulphate. The element molybdenum in association with sulphate has been shown to exert a profound influence on copper storage by the sheep. Heavy losses have at times been experienced in Victoria and New South Wales where sheep were grazing pastures dominated by subterranean clover, and with a very low molybdenum content.

Although clover dominance is much more commonly encountered here, Western Australian pastures, in general, have normal molybdenum and sulphate values. For this reason presumably toxaemic jaundice is not a hazard of clover dominance in this State.

Thirdly, some of the toxic plants which damage the liver have the effect of making this organ particularly avid for copper, so that excessive amounts are stored even when the diet is relatively low in copper content. The most important offender is a species of Heliotrope (*H. curoneum*). This plant is common in parts of Victoria, New South Wales and South Australia and has been responsible

there for numerous and serious outbreaks of toxaemic jaundice for many years. Fortunately, the plant is rare and of no significance in this State. We have some evidence here, however, which suggests that lupins may on occasions act in a similar way. Under conditions not yet understood the grazing of lupins may lead to liver damage (lupinosis) which in some cases has been associated with high liver copper values and evidence of copper poisoning. The weed Patterson's Curse has also been implicated in the East but is not known to have caused trouble here.

So much for the factors which may lead to excessive copper storage. Let's now consider the results of this. At the outset it must be realised that sheep carrying very high concentrations of copper in their livers may remain in perfect health and continue to show no signs whatever of poisoning. **Provided the copper remains in the liver there is no trouble.**

When, however, it is discharged into the circulation, blood destruction occurs, the animal becomes ill and generally dies. This sudden discharge of copper from the liver occurs particularly during stress, notably following a change of diet, a period of starvation or the effects of mustering and droving. May I illustrate from one case I remember? A flock of sheep on a certain property, maintained on copper topdressed country, had also eaten large quantities of copper lick. A draft was sent to Midland and held for slaughter at the abattoir. In this mob—subjected to stress—there was a heavy mortality from copper poisoning, whereas the mob left quietly on the home pasture, remained perfectly healthy.

In some instances, however, fat sheep undisturbed at pasture may succumb.

SYMPTOMS

Quite commonly, sheep are only noticeably ill for a few hours but death may be delayed for up to three or four days. The main signs are dullness, prostration, the occurrence of red or brown urine, and jaundice; the linings of the mouth, nose and eyes and the skin show a yellow discoloration.

The typical changes seen in the carcass are jaundice, or yellow bile staining of the tissues, and the black or gunmetal colour of the kidneys. This characteristic appearance of the kidneys serves to differentiate chronic copper poisoning from other diseases, such as lupinosis, in which jaundice occurs. The dark colour of the kidneys and urine results from the blood destruction caused by the copper and the excretion of blood pigment via the urinary tract.

In the Eastern States mortalities of over 50 per cent. have been reported. These heavy losses are commonly associated with the grazing of heliotrope. In this State occurrences of toxaemic jaundice are relatively uncommon and losses are less severe. A number of outbreaks, however, have been reported and investigated from time to time. These have been associated with excessive copper supplementation, occasionally as a sequel to lupinosis, and in a number of cases apparently as a result of the action of undetermined plant or other factors damaging the liver. On certain pastoral properties in the Goldfields and Murchison region high liver copper values are common and deaths may occur under conditions of stress associated with drought, with shearing, or with transport of sheep to market.

Under Australian conditions occurrences of the disease may be seasonal and deaths may be spread over a period of weeks or months. The Merino is said to be much more resistant than British breeds and their crosses.

CONTROL

The control of toxaemic jaundice, must depend upon the control of the various factors responsible for the development of the disease—that is of the causes leading to excessive copper storage, and of the conditions favouring heavy discharge of copper from the liver, which causes illness and death.

Excessive copper supplementation must be avoided. Copper supplements are desirable to control copper deficiency but too high a copper intake is dangerous to sheep (cattle are much more resistant).

Where liver damage due to known plants is responsible, the recommendation is obvious. In locations where high copper storage is a result of the low molybdenum content of soil and pasture topdressing

with sodium molybdate at the rate of 4 oz. per acre will rectify the position. Alternatively a lick may be used with benefit. The one recommended in the East consists of a mixture of one bag of salt (187 lb.), one bag of ground gypsum (140 lb.), and 1 lb. of sodium molybdate. So much for the prevention and control of high copper storage.

We must remember too that loss of body weight and other stresses precipitate the occurrence of disease. When the disease occurs in a flock, deaths can be minimised by good feeding and by keeping the sheep as quiet as possible. Droving, mustering and transportation must be avoided. It seems reasonable also to recommend the feeding of the lick not only to prevent excessive copper storage but also to promote a gradual reduction of the dangerous amounts of copper already accumulated by sheep in the affected flock.

DYSENTERY IN CATTLE

During the latter part of 1958, widespread outbreaks of infectious dysentery have been reported in dairy cattle throughout much of the south-western portion of the State, and the infection is still spreading.

The diseases was present amongst cattle exhibited at the Royal Show, and with the return of these cattle to their home properties, further outbreaks occurred over a large area.

The disease is highly infectious and spreads with great rapidity. Almost all of the cattle in a herd become affected in a few days and the interval from the first case until the final disappearance of the disease, is little more than a fortnight.

In the initial stages, there is reduction or loss of appetite and this is soon followed by the development of a profuse watery diarrhoea which sometimes contains flecks or larger quantities of blood and may persist for one to three days. In dairy herds, there is a sharp decline in milk production which may be reduced by one-third to one-half or more, for a period of several days.

Recovery occurs without treatment in three to five days, and except in cows which are nearing the end of their lactation and may dry off, there is a gradual return to full production. Cattle of all ages are susceptible, but dry stock do not appear to suffer any very serious ill-effects.

There is no specific treatment. Drenching with intestinal astringents and sedatives such as copper sulphate and mixtures of chalk and catechu have been recommended, but in view of the duration of the disease, and that it is probably caused by a virus, this would appear to be of doubtful value.

The disease is a new one to Australia and bears a marked similarity to the condition described as winter dysentery in Canada and the United States.

It has been transmitted to healthy cattle by bacteria-free filtrates of the excretions from affected cattle which would indicate that it is caused by a virus.

It was first reported in New South Wales early in June, and since that time, very extensive outbreaks have occurred. More recently, a series of outbreaks which stemmed from the Brisbane National Exhibition have been reported from Queensland, and there have been unconfirmed reports of the occurrence of the disease among cattle at the Royal Shows at Melbourne and Adelaide.

How the infection reached Australia has not been determined, but there can be little doubt that it was brought to Western Australia by cattle from the Eastern States which have been imported in much larger numbers than usual during recent months.

Fortunately the infection is a mild one and there is no cause for alarm. Although morbidity is high, few deaths have occurred, and apart from a brief loss of production in dairy herds, there have been no very serious ill effects.

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Weed Research...

by G. A. PEARCE B. Sc. (Agric)
BOTANIST, WEEDS & SEEDS BRANCH.

1.—WEED CONTROL IN PEAS

THE control of weeds in both field and canning peas has been of great interest to growers for many years. Despite the testing of a wide range of materials it is not possible to recommend the use of a completely safe and effective chemical capable of being applied in low volumes of water to all varieties of peas.

Experience has shown that the susceptibility of peas to weed-killing chemicals varies with the variety of pea. Two trials were undertaken in 1958, one at York on the canning variety Canners 75 and one at Southern Brook on Dunn's field peas. All treatments caused damage to the canning peas while with field peas the only treatment not causing damage was D.N.B.P.

The control of weeds by cultivation before the crop is sown remains the most practical method of weed control in peas. In many districts sufficient control can be obtained in this way to enable a comparatively weed-free crop to be grown.

The fact that peas are a somewhat slow-germinating crop enables a pre-emergence treatment to be applied to quick-germinating weeds such as wild turnip or radish before the peas have emerged. Peas take 10-14 days to emerge from the soil while wild radish and turnip often appear within 7 days. Weed seedlings this size are extremely easy to kill and such a treatment allows the peas to establish themselves without competition. Later germinations of weed seeds will of course cause concern, particularly if the crop is to be harvested.

WEED CONTROL PROGRAMME

When contemplating growing a pea crop, farmers intending to plant in paddocks normally considered to be "weedy" are advised to follow a set weed control programme. The following comments, based on experimental trials and field observations, should be considered.

1. The initial cultivation programme is most important in preparing the seed-bed. As many successive germinations as possible should be killed before planting the peas.

2. Where there is an early germination of weeds, useful results have been obtained by applying a chemical treatment two to three days before the peas emerge. Four ounces of acid equivalent of either M.C.P.A. or 2,4-D amine, plus one half gallon of 16 per cent. D.N.B.P. per acre will give good control of most weeds in this early seedling stage. The D.N.B.P. greatly assists in the control of the harder to kill weeds, such as cape-weed, and has some residual value for later-germinating weeds. This treatment can be applied with low-volume spray equipment in 5 to 10 gallons of water per acre. Such an application should enable the pea crop to compete favourably with any weeds which germinate after the peas have emerged for a considerable period.

3. Where it is intended to harvest the crop it may be necessary to consider the need of a second spray treatment. This should be undertaken when the pea crop is from 4 in. to 8 in. tall. The only chemical which can be used with safety

Fig 1.—The density of the wild radish in this paddock at Southern Brook is seen in the oat crop on the right. The pea crop on the left was sprayed before the peas emerged by Messrs. Dwyer Bros. who have shown great ingenuity in overcoming weed problems on their property

on field peas is D.N.B.P. and this must be applied in at least 50 gallons of water per acre. The nozzles normally fitted to a boom unit are not suitable for this high volume application. A nozzle such as the Monarch 39 at a pressure of 60 pounds and travelling at 2 m.p.h. will apply 50 gallons per acre.

To undertake this later treatment effectively it is necessary to use one gallon 16 per cent. D.N.B.P. in 50 gallons water per acre.

Farmers will realise that such a treatment will be very tedious and it is suggested only for crops which are to be harvested or where the presence of weeds is seriously affecting the growth of the peas.

TECHNICAL DETAILS

Treatments.

The following treatments were applied to Canners 75 and Dunn's Field peas on randomised replicated plots:—

(1) 24 oz. D.N.B.P. in 60 gals. water per acre.
(2) 6 oz. acid equivalent M.C.P.A. sodium in 7 gals. water per acre.
(3) 6 oz. acid equivalent 2,4-D amine in 7 gals water per acre.
(4) 6 oz. acid equivalent 2,4-D P.E.G. ester in 7 gals. water per acre.
(5) 16 oz. acid equivalent M.C.P.B. sodium in 7 gals. water per acre.
(6) 16 oz. acid equivalent 2,4-DB sodium in 7 gals. water per acre.
(7) 16 oz. acid equivalent 2,4-DB amine in 7 gals. water per acre.
(8) 16 oz. acid equivalent M.C.PP. in 7 gals. water per acre.
(9) 24 oz. acid equivalent M.C.P.B. sodium in 7 gals. water per acre.
(10) 24 oz. acid equivalent 2,4-DB sodium in 7 gals. water per acre.
(11) 24 oz. acid equivalent 2,4-DB amine in 7 gals. water per acre.
(12) 24 oz. acid equivalent M.C.PP. in 7 gals. water per acre.
(13) Control.

Results.

A—*Canners 75.* — All treatments severely affected the growth of the peas. Owing to the late season in 1958, many of the plants on the plots recovered and flowered approximately two to three weeks later than the peas on the control plots. Treatment 9 caused least damage to the peas while Treatments 2 and 4 were the most harmful.

B—*Dunn's Field Peas.*—Treatment 1 gave complete control of the wild radish without any damage to the peas. All other treatments caused varying amounts of damage to the crop. Apart from Treatment 1, Treatments 5, 6 and 7 caused the least damage to the peas but the control of wild radish with these treatments was poor. Along with Treatment 1 Treatments 4 and 8 gave the best weed control but the latter two were the severest on the peas.

Overall, the results suggest that under the conditions of the two trials, D.N.B.P. was the only successful treatment on the field peas while for the canning variety all treatments caused damage to the peas. Although the lower rates of the butyrics only caused slight damage to the peas the higher rates were required for reasonable weed control and these were just as harmful to the peas as the M.C.P.A. and P.E.G. treatments.

SUMMARY

(1) Two trials were undertaken for the control of weeds in peas, one on the canning variety Canners 75 and one on Dunn's field peas.

(2) No low-volume chemical treatment tested could be used indiscriminately on peas.

(3) Early germinating weeds can be controlled by spraying two to three days before the peas emerge at the rate of 4 oz. of acid equivalent of M.C.P.A. or 2,4-D amine, plus one half gallon of 16 per cent. D.N.B.P. per acre.

(4) A later spray treatment can be applied when the peas are 4-8 inches tall. One gallon of 16 per cent, D.N.B.P. should be applied in at least 50 gallons water per acre.

(5) Under the conditions of the two trials undertaken the butyric derivatives only controlled the weeds present at levels which were detrimental to the pea crop.

ACKNOWLEDGMENTS

It is desired to acknowledge the co-operation and assistance given by Mr. G. B. Barnett of Plaistowe & Co. Ltd., and Mr. F. G. Morrel of York on whose property the canning peas were grown. Also to Messrs. Dwyer Bros. of Southern Brook who co-operated with the trial undertaken on field peas.

FREE SERVICE TO FARMERS

Do you know that the Department of Agriculture provides a comprehensive service of advice and technical assistance to farmers, free of charge?

When in need of advice, get in touch with your District Officer whose name and headquarters township will be found in the list of Departmental personnel on Pages 2 and 3.

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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

PINK WAX SCALE

THE pink wax scale is a comparatively new introduction into Western Australia and so far has been recorded only from the metropolitan area. Like all scale insects it is a sap-sucker and in common with the better known white wax scale encourages the prolific growth of sooty mould fungus on affected plants. Should this pest become established in commercial orange groves, expensive spray treatment may be necessary and so every effort should be made to control the present outbreaks, and to prevent the spread of the insects to clean districts.

The following notes have been prepared to assist fruit growers and home gardeners in identifying the pest and applying the most effective control measures:—

DESCRIPTION

In its adult stage the scale is covered by a mass of pink waxy material not unlike a small blob of candle grease. The insects show a preference for tender growth and cluster on young twigs and leaves.

LIFE HISTORY

The young crawlers emerge from eggs deposited under the female scales and become active in the early summer. A second generation may appear on the leaves in March or April.

HOST PLANTS

Under local conditions pink wax scale has already been found infesting the following plants:—*Pittosporum*, umbrella trees, magnolias, lilli-pilli, Irish strawberry, ivy and N.S.W. box. In Queensland and N.S.W. the host list includes various types of citrus and quite a few bush plants.

Pink wax scale

TYPE OF DAMAGE

As the pink wax scale is a sap-sucker a heavy infestation of this pest may affect the general health of a tree or shrub. Furthermore, the honey dew excreted by the scale may so encourage the growth of sooty mould that commercial fruit may require cleaning before it is suitable for market.

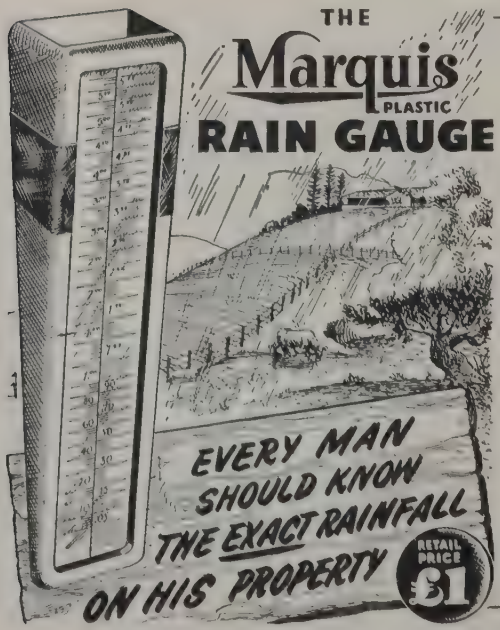
CONTROL

White spraying oil at the rate of 1 gallon to 40 gallons of water or 2 tablespoons to 1 gallon of water is used against most citrus scales and will kill the crawlers of the pink wax scale. Unfortunately, however, once the waxy covering is well developed a soda spray is necessary and the following mixture is recommended.

White Oil—1 tablespoonful (1 gall.).
Soda Ash—4 oz. (10 lb.).
or
Washing Soda—½ lb. (20 lb.).
Water—1 gallon (40 galls.).

Spray treatments should be given after the main hatching has been completed. For the first brood this should be early December and for the second brood about the end of March.

The spray should not be applied during a heat wave. Foliage burning may follow its use on some delicate plants.



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The Cultivation of Lettuce

By W. H. KOOYMAN, Vegetable Instructor, Horticultural Division

LETTUCE is one of the most popular salad vegetables and is widely grown in Australia. In Western Australia most of the lettuce is grown during spring, summer and autumn on the sandy soils of the metropolitan area. A small portion is grown during winter. In recent years the cultivation of lettuce has been difficult in many of the gardens of the metropolitan area and the question "Could you tell me what is wrong with my lettuce?" has been asked on many occasions.

As cultivation of lettuce is of importance to the grower as well as to the public, I would like to discuss some aspects of cultivation of this vegetable. Because lettuce is a cool weather plant it generally does well under relatively cool conditions with a maximum of sunshine. Temperature and soil moisture are important in the successful production of lettuce. Preparation of the soil for planting and growing is much the same as for growing other vegetables, and a thorough cultivation will do much to assure a good stand of plants, and reduce labour after the crop is planted. At this time of the year, the bulk of the lettuce is planted direct, while later in the season many growers raise the young plants in seed beds. The seed is often planted by hand, but a small proportion of the commercial growers use mechanical seed-drills.

After the seed is planted it is necessary to keep the moisture content of the soil at a high level, and several irrigations may be necessary—the frequency of the irrigations depending on temperature and general conditions of the soil. Light dressings of well-rotted organic manure are often applied on the seed beds, as this may help to maintain the moisture; it also serves to keep the soil cool during hot weather.

The seeds usually germinate in four to five days after planting and the seedlings emerge soon after. It is a good practice to give the young plants a light dressing of blood and bone when they are one week old.

It must be borne in mind that the right type of any particular variety should be planted for each season. An out-of-season variety may result in seed-stalk formation, or the plants may remain bushy and form soft, puffy heads.

Thinning-out is a much more important operation than many growers realise. It is at this stage that a grower decides which plants are going to become his crop. It is essential that only the healthy plants remain in the field, as many of the dwarfed and stunted seedlings may be infected with diseases such as "lettuce mosaic" and "big vein." The experienced grower will do the thinning-out in two stages. The first operation takes place at an early stage, the plants being spaced at a distance of two to three inches in the row. The final operation takes place ten days later. The plants are then four to five inches high, and well-developed. At this stage, any seedlings affected by disease may be easily recognised and dealt with accordingly. Care should be exercised not to leave the plants too close together, as over-crowding may delay maturity, and cause only small heads to be formed.

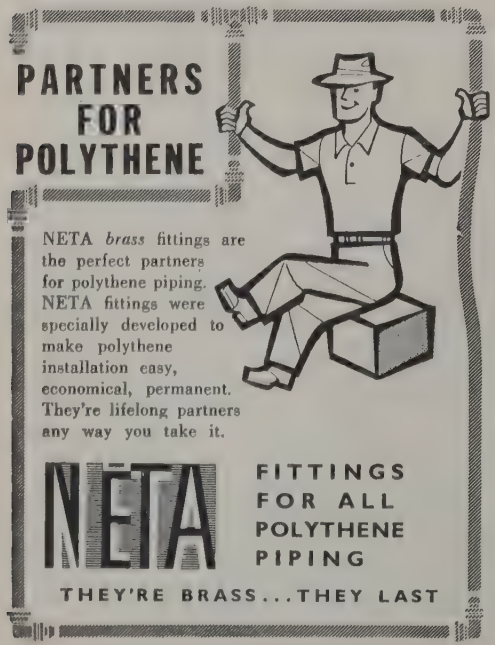
Fertilisation is important in the cultivation of lettuce since it is a quick-developing crop. Fertiliser should be applied as side dressings in small quantities at frequent intervals, as high soil fertility levels must be maintained for good lettuce production. Lettuce requires constant moisture from planting to harvest. A wide fluctuation of soil moisture is undesirable at any time, and may cause damage to the crop in the later stages of development.

When irrigation water is applied from a sprinkler system during warm weather it is recommended that the first watering should be applied during the morning before the plants reach wilting point. Losses from "tipburn" and "slime" may result from careless irrigation of nearly-mature lettuce crops. Heavy applications of water during the hottest hours of the day are undesirable and frequent waterings of short duration are to be preferred.

Over-irrigation is quite as harmful as an insufficient water supply, and may favour the development of fungus diseases in the crop. Careful attention to irrigation will save fertilisers, and ensure that the crop receives no setback due to shortage of plant foods.

Lettuce should not be grown frequently on the same land, and some system of crop rotation should be followed. Crop rotation is important because it tends to reduce soil-borne agents which may be the cause of serious disorders in the crop. Plants differ in their feeding habits, in that they remove various elements from the soil in different amounts.

There are well over 1,000 varieties of lettuce, but in Western Australia the most popular is Great Lakes. This variety is able to produce marketable heads under adverse climatic conditions, and is favoured by most growers.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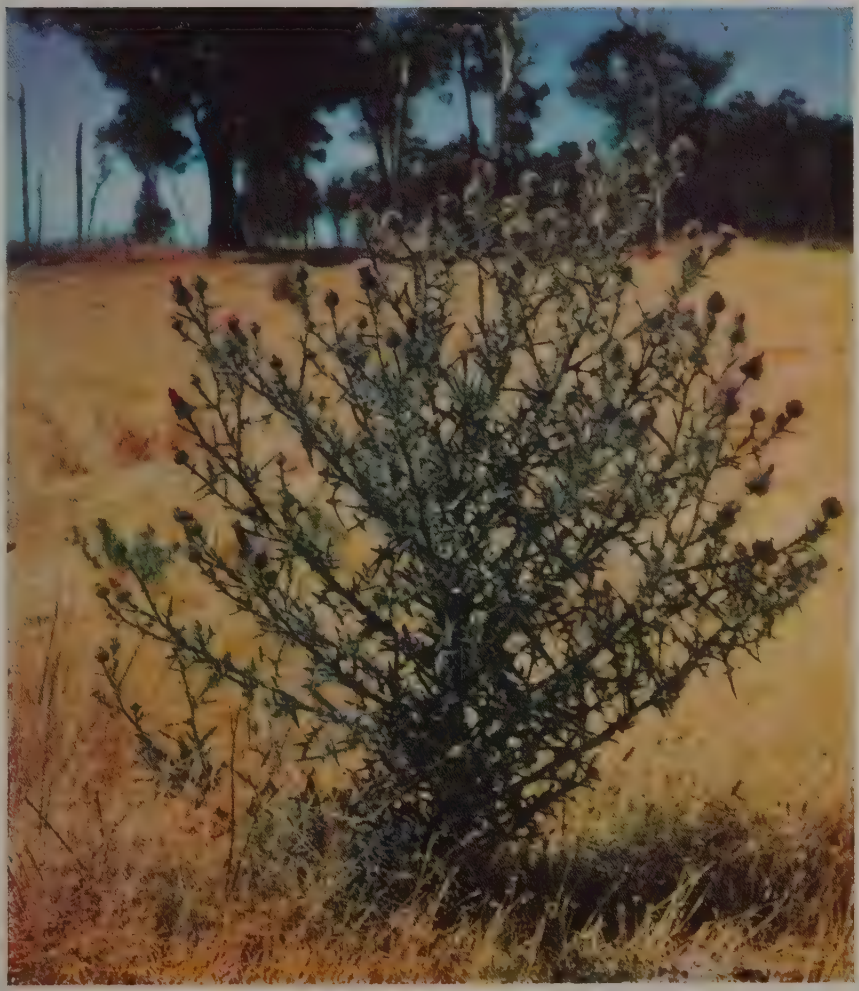

SPEAR THISTLE

(*Cirsium lanceolatum* (L.) Scop.)

A number of thistles have become serious weeds in Western Australia. Some such as Canada and Berkheya thistles are perennials, others, including Saffron and Sheep thistles, are annuals, while Spear thistle is a biennial. During the first year a large basal rosette of leaves is formed followed by the flowering stem in the second year.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

SPEAR THISTLE

(*Cirsium lanceolatum* (L.) *Scop.*)

A NUMBER of thistles, including Canada, Berkheya and saffron have been dealt with in previous articles. The first two are perennials, living for an indefinite period, while saffron thistle completes its life cycle in one year. Spear thistle, the subject of this article, is intermediate, usually being a biennial. During the first year it produces a rosette of large, very spiny leaves, the flowers and seeds being formed during the second season of growth.

Spear thistle is native to Europe and Asia but is now naturalised in most temperate countries. It is common in many wheat growing districts in Canada and the United States and occurs quite freely in Australia and New Zealand. In this State it is restricted to areas having a relatively long growing season, being found mainly in the higher rainfall belt of the South-West. It grows most vigorously and is most persistent on heavier soils but is not confined to them.

DESCRIPTION

Spear thistle is known as bull thistle in Canada. It is also referred to as Scotch thistle, a name applied from time to time to a number of plants other than that accepted as being the heraldic Scotch thistle. As already mentioned, it is a biennial, a large, flat rosette of leaves arising from a deep, fleshy taproot during the first year. These basal leaves are stalked and sometimes more than a foot in length. Each leaf is deeply lobed, the lobes ending in long, sharp spines. These along with further spines on the upper surface leave no doubt why the plant is known as spear thistle.

The stem, formed in the second year, is up to five feet in height and is usually branched. It is spiny-winged and slightly woolly and the leaves it bears are similar to those of the basal rosette but somewhat smaller. Each plant produces a number of large, purple flower heads, sometimes three inches across when mature. The seeds are quite large, being about one sixth inch long, smooth or slightly furrowed, blackish or black streaked on a yellowish background. The hairs of the parachute or pappus are long, white and feathery but do not remain attached to the seed for very long and are not a great help in its distribution by wind.

SIGNIFICANCE

About 20 years ago, spear thistle was blamed for the loss of horses in New South Wales but there has been no confirmation of toxic properties. If responsible for maladies, mechanical injury by the spines rather than any toxic content is likely to be the cause. Thistles in general have the well-earned reputation of being spiny, and spear thistle, as the name implies, is one of the worst in this respect. For this reason it is seldom eaten by stock although they show some liking for the near-ripe seed heads.

The main significance of spear thistle as a weed is the smothering effect of the

SPEAR THISTLE
A—Plant; B—Leaf showing the spiny surface; C—Seed and pappus
(Canadian Department of Agriculture.)

large basal rosettes on pasture species. Stock also tend to avoid grazing in their immediate vicinity, except, when the seeds are approaching maturity. Again hay or chaff containing spear thistle, besides being unattractive to stock, is uncomfortable to handle.

CONTROL

Spear thistle is seldom a problem on arable land as it does not persist under cultivation. Control measures, therefore, are usually directed against the weed growing in pastures or on waste land. Being a biennial, seed formation can be prevented by destroying the plant, even during the second season of growth. Fortunately the seeds do not have a long period of dormancy as is the case with weeds such as wild radish and doublegee. They are also comparatively heavy and, as the parachute falls off very readily, are seldom carried any distance by wind.

As already mentioned, ploughing is an effective means of control but is seldom desirable where pastures are concerned. Isolated plants can be handled by cutting the rosette well below the crown. Mowing can be very helpful but, in order to be effective, must be undertaken during a relative limited period. If carried out too late, seeds will be formed, while if too early, new shoots may mature, especially in moist places.

The hormone-like herbicides, particularly the ester of 2,4-D, are also effective against spear thistle. The plants are most susceptible when small and 1 lb. of acid equivalent per acre is usually sufficient. If the plants are scattered, they can be spot-sprayed with a knapsack or hand-wand from a power unit. A low-volume boom can be used for more general infestations but spear thistle is not one of our more widespread weeds and this method is seldom warranted in Western Australia.

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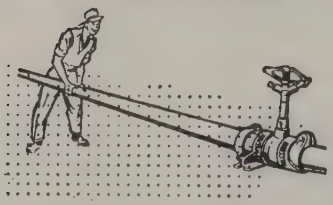

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SILAGE COMPETITION, 1957-58

By H. G. ELLIOTT, Assistant Superintendent of Dairying

IN 1957 the Australian Dairy Produce Board Pasture Improvement Committee (W.A.) sponsored a competition with a view to encouraging greater utilisation of pasture by the conservation of the spring surplus as silage. The committee has as its objective the encouragement of the making of a high protein silage suitable for cows in milk during the summer. The competition was judged in two sections:—

A—Quality, and B—The farmer's workmanship in ensiling and in feeding the silage to his cattle.

In Section A judging was carried out according to the following point scale.

	Points.
(1) Material ensiled, botanical composition	15
(2) Maturity of herbage	25
(3) Colour	10
(4) Aroma	10
(5) Protein	25
(6) pH	15
Total	100

In finalising judging however, it became evident that an allocation of points for pH would be misleading as it could be applied only on the assumption that there was a direct relationship between pH and the percentage of nutrients retained and therefore success in making. Consequently it was eliminated.

Section B was included in order to emphasise the need for good workmanship in making silage and for avoiding unnecessary labour in making and feeding. Improper methods can lead to loss of nutrients by fermentation and a loss of silage in bulk by drying, rotting, or moulding. Prizes in this section were offered according to the following methods:—

(1) Pits or clamps (long).
(2) Pits or clamps (baled).
(3) Pits or clamps (chaffed).
(4) Stacks (long).
(5) Stacks (baled).

The point scale was:—

	Points.
(1) Wastage	50
(2) Methods of opening	25
(3) Methods of feeding	25
Total	100

The number of entries was very pleasing and was as follows: —

Section A—40.

Section B—

	Points.
(1) Pits or clamps (long)	6
(2) Pits or clamps (baled)	8
(3) Pits or clamps (chaffed)	8
(4) Stacks (long)	18
(5) Stacks (baled)	Nil
Total	40

Judging was carried out by Agricultural Advisers of the Dairy Division of the Department of Agriculture in their own districts and, as the prizes were awarded on a State-wide basis, some variation in interpretation was unavoidable but this is considered not to have caused any undue bias. The judges were Messrs. R. S. Sprivulis, A. W. Hobbs, B. Williams, A. L. Hamilton and J. Carberry.

PRIZE WINNERS

Section A.

	Points.
(1) N. V. Rose, Wilgarrup	81
(2) M. Flynn, Bunbury	80
(3) S. Dawson, Manjimup	76

Mr. Rose's entry was judged by Agricultural Adviser Mr. R. Sprivulis. It was made in a pit from long pasture herbage com-

prising *Phalaris tuberosa,* subterranean clover and some annual volunteer grasses. It was cut first, before flowering, and had a clean pleasant aroma and dark green colour. Its crude protein content was 19.9 per cent.

Mr. Flynn's entry was judged by Agricultural Adviser Mr. B. Williams. This entry was of oats and purple vetch and contained approximately 100 tons. It was ensiled in a pit on a sandy ridge in a central position on the farm. The quality was very good, scoring highly under each subsection. Crude protein was 18.5 per cent. Mr. Williams reported that Mr. Flynn attributes the maintenance of his milk output during the summer, in no small measure to the use of this silage. His sudan grass crop on which he was relying was only moderately successful and without the silage, milk output would have been reduced.

Mr. Dawson's entry was judged by Mr. R. Sprivulis, and comprised a half-cylindrical stack of chopped subterranean clover, Wimmera ryegrass and some capeweed and other minor plants. It was cut at the flowering stage and had a clean pleasant aroma with dark green colour. The protein, 19.8 per cent. was very good.

Section B.

Some useful and interesting information has been supplied by judges in commenting on the judging of Section B. Unfortunately, however, the early resignation of one judge has resulted in no comments being available for entries in the Denmark Albany districts.

The winners of this Section were:—

Subsection—

(1) Pits or clamps (long)—A. J. Chanter, Denmark.
(2) Pits or clamps (baled)—Mr. M. Flynn, Bunbury.
(3) Pits or clamps (chopped)—Mr. N. V. Rose, Wilgarrup.
(4) Stacks (long)—Mr. W. Middleton, Denmark.

GENERAL COMMENT

As a means of stimulating interest in making silage of a quality suitable as a protein supplement to cows in milk during the summer months the competition was very successful.

It has proved also that silage of high protein content can be made but also has demonstrated that much silage, while of value for maintenance, is of little value as a protein supplement for cows in milk. The percentage of crude protein ranged from 7.2 per cent. to 19.9 per cent.

An examination of the tables attached will allow each competitor not only to know his point allotment but also the percentage of crude protein in the sample taken for analysis. The data is valuable, even to indicate that much protein and other nutrients have been lost in ensiling. It is difficult to believe for example, that percentages of the order of 8.6 per cent. or 7.2 per cent. of crude protein in silage are reliable guides to the composition of the original herbages.

This is not the place to set out details of successful silage making but the following points are important. Those who wish to receive more detailed information should consult their local Agricultural Advisers.

(1) The objective of silage making is to conserve the maximum amount of nutrients in the cut herbage in a succulent and palatable form.
(2) No more nutrients can be obtained in silage than are in the original herbage at cutting.
(3) Considerable losses of nutrients can and do occur in making.
(4) Good herbage is necessary to make good silage.
(5) Losses of nutrients can be reduced by the promotion of rapid acidification in order to stop fermentation before too great changes have occurred.
(6) Rapid production of acid is encouraged by having a good herbage mixture of approximately 70 per cent. moisture content and well consolidated so that little air is retained.
(7) Weighting or covering the surface or the production of a seal by rolling will reduce physical wastage by spoilage, i.e., rotting, mouldiness, etc.
(8) The fact that stock will eat spoiled silage does not make it good.

(9) Broadly—herbage for silage should be cut early, not later than flowering, wilted slightly, and stacked rapidly with good consolidation. Techniques will vary with the composition of the herbage and climatic conditions.

JUDGES' COMMENTS

On the question of workmanship, wastage, etc., some very good results were reported by the judges. A typical comment was:—

> **Wastage.—As** would be expected, large variations occurred in the degrees of wastage. Best results seemed to have been obtained with rectangular stacks using a grassland forage harvester. The material harvested by this method seemed to pack down tightly and surface wastage was reduced to a minimum without any elaborate treatment of the stack. Depth of wastage in the three entries ranged from approximately 2 in. to a maximum of 3½ in. to 4 in. The most wastage occurred in a bun-shaped stack made from a very grassy paddock using a buckrake, and in a wedge formed by the same method. Half pits of baled silage also lost points due to surface wastage although little waste occurred within the stack.

Mr. Hamilton, whose comments are above, referred to convenience in feeding as being a major consideration. He expressed the view that farmers are still somewhat loth to make silage because of the heavy task which can be imposed in getting it from the silo to the cattle. The variety of methods seen indicates that farmers' ingenuity will overcome this problem.

Mr. Hamilton further said there is an obvious advantage in the recommended method of stacking bales in pits so that a continuous line of bales is placed across the stack as compared with the method of interlocking bales, both from the point of view of ease of removal and of preservation of a straight face as each day's feeding is carried out. Two competitors, he said, lost points due to the ragged face left after interlocked bales were removed in opening. He allotted additional points to baled entries over other methods because of ease in handling bales in daily feeding compared to loose material.

On the other hand, Mr. B. Williams expressed himself as follows:—

> In my opinion it is questionable whether the convenience of baled herbage in filling the pit justifies the extra difficulty met in feeding it out.

It is obvious that opinion is not yet unanimous regarding the advantages of any one method of making silage. The tendency of the chopped silage harvested with a forage harvester to permit a shallow seal on the surface is of considerable interest. This will be of greatest value if such material can be conserved in silos with a reasonable depth. A shallow seal spread over a large surface area in comparison to volume may not achieve any advantage.

The methods used by Mr. A. Read of Bridgetown in making silage from forage harvested material and later in feeding it to his cattle are of interest. An elongated bun stack was made using subterranean clover and ryegrass. The quality of the silage was not high, as the material was cut late and colour and aroma were poor while the crude protein content 12.4 per cent. was a little too low.

The dumped herbage was rolled by the tractor resulting in a moist seal being formed from the lacerated and bleeding material.

Under the seal the silage was uniform. In opening, a part of the seal was lifted and the silage cut with a hay-knife. A tractor and trailer were used to take it to the stack. The tractor was allowed to run downhill in low gear without direct control while the farmer threw off the silage.

Most entrants used some labour-saving methods but relied principally on forking on to a conveyance and then forking back to a paddock.

Many used hay-knives to cut slabs and most relied on forks where the material was ensiled long or chaffed.

Other typical comments by judges were:—

> **R. Sprivulis.** All entrants except one make silage as a regular task and if it had not been for the previous dry spring, more would have been made. There was increasing interest in the use of forage harvesters.

It was evident that where good succulent material was properly compressed wastage was low.

Farmers generally were impressed with the value of silage in feeding more particularly from before calving and while pastures were getting away in the Autumn.

A. W. Hobbs. A feature of the best entries was the small amount of wastage. The worst, however, were cut too late and consolidation was insufficient. Some as a consequence were mouldy. The majority, however, were quite palatable. Feeding started in March mainly to cows both in milk and dry.

POINT ALLOTMENTS

Details of the point allotments in the various sections are as follows:—

Section A

1. PIT OR CLAMP LONG

Name and Address	Crude Protein per cent.	Material Ensiled (15)	Maturity of Herbage (25)	Colour (10)	Aroma (10)	Protein (25)	Total (85)
S. J. Mullins, (1) Waroona	16·0	12	19	6	8	19	64
V. and R. Goode, (2) Brunswick	13·4	14	20	6	6	16	62
V. and R. Goode, (1) Brunswick	11·4	14	21	7	7	12	61
A. J. Chanter, Denmark	12·2	12	18	7	7	14	58
Leaver Bros., Byford	13·5	9	20	5	4	16	54
G. S. Donaldson, Northcliffe	8·6	10	13	3	3	7	36

Section A

2. PIT OR CLAMP BALED

Name and Address	Crude Protein per cent.	Material Ensiled (15)	Maturity of Herbage (25)	Colour (10)	Aroma (10)	Protein (25)	Total (85)
M. Flynn, Bunbury	18·5	14	24	10	9	23	80
S. Garstone, Cowaramup	17·6	12	20	8	8	22	70
W. K. Barnes (1), Benger	15·1	10	18	6	8	20	62
C. Summerfield, Witchcliffe	13·5	10	18	7	6	17	58
W. T. Mitchell, Coolup	11·3	13	15	6	6	12	52
W. J. Rowe & Son, Witchcliffe	10·1	13	14	5	7	10	49
W. K. Barnes (2), Benger	9·4	9	17	6	7	8	47
Brownes Ltd., Coolup	9·5	12	16	5	6	8	47

Section A

3. PIT OR CLAMP CHOPPED

Name and Address	Crude Protein per cent.	Material Ensiled (15)	Maturity of Herbage (25)	Colour (10)	Aroma (10)	Protein (25)	Total (85)
N. V. Rose, Wilgarrup	19·9	12	25	10	10	24	81
S. Dawson, Manjimup	19·8	12	20	10	10	24	76
J. O'Neill, Hithergreen	15·1	13	20	8	8	20	69
F. J. Oates, Abba River	13·0	15	22	7	8	16	68
C. Semmens, Abba River	13·6	15	22	6	5	17	65
C. Waugh (2), Manjimup	13·8	10	20	10	8	17	65
N. U. Moltoni, Manjimup	16·7	12	15	5	5	21	58
A. Read (2), Bridgetown	7·2	14	22	8	8	4	56
C. Waugh (1), Manjimup	13·2	10	15	7	7	16	55

Section A

4. STACKS LONG

Name and Address	Crude Protein per cent.	Material Ensiled (15)	Maturity of Herbage (25)	Colour (10)	Aroma (10)	Protein (25)	Total (85)
S. J. Mullins (2), Waroona	14·6	13	22	8	8	21	72
A. J. Phillips, Coolup	16·7	10	21	6	7	21	65
N. Barge, Nillup	15·7	12	21	4	6	20	63
W. Middleton, Denmark	14·7	12	18	7	7	19	63
H. D. Styles (1), Manjimup	15·3	8	18	8	7	20	61
Sale Bros., Balingup	12·5	14	16	8	7	15	60
Angel & Son (2), Manjimup	13·6	7	20	7	8	17	59
E. F. Howard, Bridgetown	10·4	12	18	8	7	10	55
F. Thatcher, Byford	11·6	10	20	5	7	13	55
Angel & Son (1), Manjimup	12·8	10	15	7	7	15	54
W. Hamilton, Jardee	15·5	10	13	5	6	20	54
N. L. Marsh, Mundijong	9·3	11	20	6	8	8	53
A. Read (1), Bridgetown	12·4	14	15	4	3	14	51
J. M. Oldfield, Forest Grove	11·7	7	15	7	7	13	49
H. D. Styles (2), Manjimup	15·2	10	13	3	3	20	49
D. R. Hodgson, Waroona	9·7	10	17	5	6	9	48
F. E. Bailey, Denmark	15·8	5	9	2	2	20	38

Section B

1. PITS OR CLAMPS LONG

Name and Address	Wastage (50)	Method of Opening (25)	Convenience in Feeding (25)	Total (100)
A. J. Chanter, Denmark	40	23	22	85
S. J. Mullins, Waroona	43	21	14	78
Leaver Bros., Byford	42	20	14	76
V. and R. Goode (1), Brunswick	43	18	13	74
V. and R. Goode (2), Brunswick	40	19	15	74
G. S. Donaldson, Northcliffe	30	20	15	65

Section B

2. PITS OR CLAMPS BALED

Name and Address	Wastage (50)	Method of Opening (25)	Convenience in Feeding (25)	Total (100)
M. Flynn, Bunbury	40	18	20	78
W. K. Barnes, Benger	37	21	15	73
W. K. Barnes, Benger	38	20	15	73
S. Garstone, Cowaramup	35	18	20	73
W. T. Mitchell, Coolup	36	20	15	71
Brownes Ltd., Coolup	38	17	13	68
C. Summerfield, Witchcliffe	30	15	20	65
W. S. Rowe & Son, Witchcliffe	30	12	20	62

Section B

3. PITS OR CLAMPS CHOPPED

Name and Address	Wastage (50)	Method of Opening (25)	Convenience in Feeding (25)	Total (100)
N. V. Rose, Wilgarrup	47	25	15	87
A. Read (2), Bridgetown	45	23	18	86
F. J. Oates, Abba River	45	20	15	80
J. O'Neill, Hithergreen	41	22	15	78
C. Semmens, Abba River	40	22	15	77
S. Dawson, Manjimup	40	20	15	75
C. Waugh (1), Manjimup	40	20	15	75
C. Waugh (2), Manjimup	40	20	15	75
N. H. Norton, Manjimup	35	20	15	70

Section B

4. STACKS LONG

Name and Address	Wastage (50)	Method of Opening (25)	Convenience in Feeding (25)	Total (100)
W. Middleton, Denmark	40	23	20	83
S. J. Mullins (2), Waroona	46	20	14	80
E. F. Howard, Bridgetown	40	21	18	79
Sale Bros, Balingup	42	20	17	79
F. Thatcher, Byford	43	20	14	77
N. L. Marsh, Mundijong	40	20	13	73
Angel & Son (1), Manjimup	40	15	15	70
D. R. Hodgson, Waroona	38	18	14	70
H. D. Styles (1), Manjimup	35	20	15	70
A. J. Phillips, Coolup	35	18	14	67
Angel & Son (2), Manjimup	35	15	15	65
N. Barge, Nillup	28	18	15	61
F. E. Bailey, Denmark	20	20	20	60
W. Hamilton, Jardee	30	15	15	60
J. H. Oldfield, Forest Grove	25	20	15	60
H. D. Styles (2), Manjimup	25	20	15	60

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Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

Fig. 1.—Drying retted flax

Flax as a Rotation Crop in the Higher Rainfall Areas of Western Australia

By H. G. ELLIOTT, Assistant Superintendent of Dairying, and F. E. RYAN, Agrostologist

FLAX variety trials have been in progress at Bramley Research Station for three seasons and at Manjimup for two seasons, to determine if this crop would be a suitable cash rotation one. The results of these experiments were published earlier under the title of Flax Variety Experiment at Bramley and Manjimup, 1955-57, by Messrs. H. G. Elliott and F. E. Ryan.

Up to the present time the variety "Concurrent" is the standard commercial one which has been used in the flax growing areas at Boyup Brook and for the purposes of determining the value of this crop for the dairying districts as a cash crop rotation, the average yield of this variety is taken as a basis for determining results.

BRAMLEY

The average yield of the "Concurrent" variety for the three years was equal to 1.74 tons per acre and basing the straw at better than standard price at which it was valued at each year, the following would be the gross returns per acre.

1.74 tons straw at £15 10s. per ton = £26 19s. 5d. It can be estimated that if the farmer carried out his own cultivation, planting, stooking, loading and supplied the fertiliser, fuel, etc., his cash outlay would not exceed £2 12s. per acre as the cost of seed, pulling, twine and cartage can be deducted from the crop proceeds after delivery to the processing mill. This amount has been estimated at £6 5s. per acre.

From the above it will be seen that the net returns per acre would be:—

	£ s. d. Per Acre.
Gross Value of Straw	26 19 0
Cash Outlay	2 12 0
Other deductions on delivery	6 5 0
Net Return	18 2 0

With the above, cartage costs have been based on the assumption that all mileage in excess of 20 miles would be subsidised by the processing mill. No charge was made for the farmer's labour or depreciа-

tion on his plant. In the cash outlay items such commodities as fuel, fertiliser, and spraying materials, have been taken into account.

A nett return of £18 per acre for a cash rotation crop is worthy of consideration by farmers in the dairying areas, and if contracts can be made with the processing mill, consideration should be given to the growing of this crop. With efficient cultivation and good farm management this crop would, on well drained old pasture country, yield much better than the average which has been obtained to date in the flax growing areas.

Apart from the above considerations the land would be in excellent order for the following year when a good pasture mixture could be planted early.

acre between highest and lowest producing variety in 1957.

MANJIMUP

The average yield of Concurrent for two years at Manjimup was 2.35 tons to the acre and taking this variety as the standard, the following returns might be expected if similar yields are maintained.

The 2.35 tons of straw valued at £16 per ton would give a gross return to the farmer of £37 12s. Providing the farmer did his own work such as cultivation, planting, stooking and loading, it is estimated that the cash outlay for fuel, fertiliser and if necessary spraying for pests would not exceed £3 per acre, as the balance for seed, pulling, twine and cartage would be deducted from the proceeds of the crop

RESULTS BRAMLEY RESEARCH STATION, 1957

Variety	Original Straw Weight	Yield of Products per Acre		Gross Mill Value of all Products per Acre
		Line Fibre	Line Fibre per cent. on Original Weight	
	cwts./acre	lb.		£
Concurrent 85 lb./ac.	28·1	404	13·9	76
Boyup 85 lb./ac.	27·9	356	11·4	64
Wada 100 lb./ac.	26·9	347	11·9	62
Wada 85 lb./ac.	26·5	307	11·6	60
Wiera 85 lb./ac.	22·4	324	12·9	58

From the above table it will be seen that the variety "Concurrent" gave the highest straw yields per acre and the highest percentage line fibre as well as the greatest gross value for all products when recovered at the Mill. This represented the saleable value after processing at £76 per acre. It will be seen that the lowest gross value of processed products was £58 per acre a difference of £18 per after delivery at the Mill. This is estimated allowing for cartage adjustment by the Mill at £8 10s. per acre.

It will be seen from this that the nett return per acre would be £26 2s.

2.35 tons @ £16 per ton =		£37 12 0
All costs		
Cash outlay £3		
Mill deductions £8 10 0		£11 10 0
		£26 2 0

RESULTS C. LEFROY, MANJIMUP, 1957

Variety	Original Straw Weight	Yield of Products per Acre		Gross Mill Value of all Products per Acre
		Line Fibre	Line Fibre per cent. on Original Weight	
	cwts./ac.	lb.		£
Concurrent	54·9	1,117	19·1	165
Boyup	50·2	947	17·2	142
Wiera	49·4	1,008	18·2	148
Wada	54·9	921	16·8	140

The above figures do not take into consideration the cost of the farmer's own labour or depreciation on the plant which was used.

COMMENT

A payable cash crop would be of considerable advantage on farms in the dairying districts for renovation of existing pastures, suppression of weeds, and for sowing of improved species of pasture plants. In very limited areas potatoes provide such a crop but results of the present series of experiments suggest that fibre flax could provide an alternative with a wider application.

It is considered that if flax is grown in these areas the area sown to this crop would be less than 1/15th of the pasture area of the property and that the paddocks used would be those most in need of cultivation and renovation and of low production under grazing. Consequently this would not be expected to interfere very much with the normal carrying capacity of the property.

Improved production could be expected from these paddocks following the flax crop resowing with pasture and more than compensate for the area excluded from grazing.

Although flax is grown commercially at present within a 30 mile range of the Mill at Boyup Brook an endeavour has been made to compare these experimental results with the commercial crops grown there.

Many growers in the Boyup area produce much heavier yields than the average for the district so a comparison of experimental results from one or two sites elsewhere with the district average is not strictly correct, but the results are encouraging from the following points:—

(1) Yields of Straw.

At Bramley for the three years 1955-56-57, the average mean yield of straw (original weight) was 32.5 cwts. per acre. At Manjimup for the two years 1956-57 the mean yield was 48.6 cwts. per acre; whereas at Boyup Brook the average for the three years 1955-57 of all commercial crops was 26 cwts. per acre.

If the Concurrent variety is accepted as the standard the average yields would provide an estimated nett return of £18 2s. per acre at Bramley and £26 2s. per acre at Manjimup at the present ruling price for straw.

(2) Fibre Recovery.

The recovery of fibre from the straw produced at Manjimup in 1957 was 17.8 per cent., Bramley 12.3 per cent. and the overall crops at Boyup Brook 11.0 per cent.

Fig. 2.—A flax crop in flower

Such increases in fibre recovery as obtained from the Manjimup straw would go a long way to reducing the cost of fibre production to a level at which it could be sold on the world market, providing the high recovery was consistent.

In addition a higher price per ton could be paid by the Mill for straw with such a high fibre content and this would improve the farmer's return per acre.

(3) Value of Products.

If the Concurrent variety is taken as a standard the gross Mill value of the fibre, tow, seed and chaff from this variety grown at Bramley was worth £76 per acre, at Manjimup £165 per acre, consequently if the same yields of straw together with

the percentages of extraction of products at the Mill were maintained flax production at Manjimup would have a very bright future. In order to obtain more information from a wider area at Manjimup commercial crops have been planted on three sites as well as three experiments during this season, 1958.

(4) Varieties.

"Concurrent," "Boyup," "Wada," and "Wiera" varieties have been used in these trials, and all four have produced equally well at Manjimup, whereas "Concurrent" and "Boyup" have consistently yielded well at Bramley.

CONCLUSIONS

Both districts have shown that they are suitable for growing flax for fibre with best results to date from Manjimup. Further studies are being made at Manjimup on Times of Planting, Fertilisers, Drilling V Broadcasting and Varieties, for the purpose of determining if increased yields of straw and fibre can be obtained.

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THE RABBIT POPULATION IN W.A.

By A. R. TOMLINSON, Chief Vermin Control Officer

SO much misunderstandng and confusion regarding the rabbit position in Western Australia appears to have arisen that possibly a brief explanation may be of help. Most of the difficulties seem to come from misunderstanding and misquoting of reports made by my officers and myself. For instance, I am supposed to have said that rabbits had increased ten times throughout Western Australia and also that they are present in plague form. Such allegations are obviously absurd, particularly as so much care has been taken to keep reports factual.

Probably it will be helpful if I explain some important points regarding rabbit populations, their breeding and rate of increase. For some years prior to 1955, W.A. had a rabbit population at almost saturation point. They bred up during winter and spring, but by the end of summer, natural factors such as water and feed shortages, animal and bird enemies, diseases, etc., had normally reduced them considerably. A further reduction resulted from destruction measures by man.

WINTER INCREASES

However, about a month after the first winter rains, most of the does would have litters averaging five young and this could be repeated at monthly intervals until the finish of green feed in late spring. By this time young does from the first litters would also be breeding. The natural death rate is high, but the population would be restored within a season, and could be increased many times quite easily under favourable conditions. (A 90 per cent.

mortality is necessary to offset this high breeding rate.)

Secondly I might explain that satisfactorily describing wild animal populations is something which has always baffled those concerned. For instance how can we express numbers of rabbits in comparative terms, when local conditions differ so greatly. A "large number" of rabbits in eastern districts of this State would be considered a small number in the western areas. As a result we are forced to make any references to populations relate to each particular area, which can make any general statements rather sweeping. A doubling of population could mean increasing from two to four in some places, and 200 to 400 in others. Furthermore, with different production capacities in our agricultural areas, a few rabbits in one place could cause as serious a loss as a large number elsewhere. At any rate, the most satisfactory way we have of expressing population trends is using such terms as "doubling" or "halving" or by percentages. Any other method is meaningless or confusing.

BIG REDUCTIONS

As everyone knows, myxomatosis caused the first really significant artificial fall in rabbits here. The big general drop was in 1955, and 1956 (with the Northern agricultural areas earlier) and the "1080" poisoning drives have assisted greatly especially where myxomatosis was less effective.

The population reduction was very heavy, and many farmers will agree was probably 90 per cent. to 95 per cent. of the rabbits. On most properties rabbit numbers are so low compared with what they were before that to the owners they might appear insignificant. Even under normal circumstances, less than half the population can be seen, but now all the survivors are very shy and are rarely seen in daylight. Scratches in the ground are often the only indication of their presence. However it is essential to change our assessment of the situation from the former plague numbers to the present low levels and to change the approach to destruction work from control to prevention of a build-up. It is on these present low levels that I am basing all my calculations of population changes and urging extensive preventive action.

The breeding pattern I mentioned earlier in conjunction with the knowledge that the myxomatosis mortality rate is now ranging from 90 per cent. to as low as 40 per cent., gives a key to the real position to-day. The few rabbits which were left are breeding just as busily (five distinct successive batches of young kittens were observed in one region last year), but to the natural hazards are added the declining myxomatosis and the organised "1080" poisoning drives which together are still exercising a fairly high controlling effect.

By early summer, the rabbits left over after the previous season have increased to their maximum, but by the end of summer they will have been reduced again to their minimum level for the year. My field officers and myself are attempting to assess the population trends, particularly at these maximum and minimum points while allowing for normal fluctuations.

INCREASE RECORDED

There can be no doubt there has been a general increase. I make haste to add that it has varied from region to region, and often from property to property, but the overall population is still not as low as it was two years ago.

The rise may appear insignificant in some areas (only four rabbits where there were two), but our earlier history shows that an increase anywhere is a threat to all the agricultural areas. Probably even with comparatively limited control work, the return of rabbits to their previous plague numbers could still take several years, but it would come.

The present public attitude has apparently been little different from what it was when rabbits were first commencing to spread in W.A. many years ago. No doubt depending largely on the private opinions of each individual, as well as the extent of rabbit penetration onto his

property, in those days some were concerned while others were not worried. Some said it could not happen here and opposed active control or prevention measures. Surely what happened then should be a lesson to us all now, that it can and will happen again if we allow ourselves to be lulled into an acceptance that rabbits are finished for all time. The greatest emphasis should no longer be on control but prevention.

Observations made by the Chairman of the Road Board Association to the December, 1958, meeting of the Agriculture Protection Board indicate an encouraging awareness of the position among some leading representatives of farmers and local authorities. He stated that reports had just been made to the executive of his Association of a general increase in rabbits extending over most of the infested areas. These reports coincide with the seasonal maximum population, but their significance lies in the fact that the annual build-up has now become sufficiently noticeable for comment.

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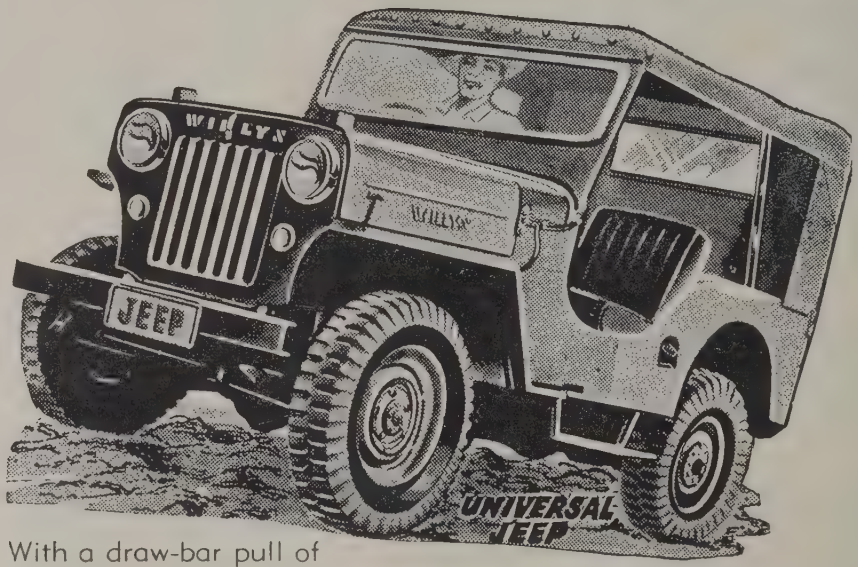

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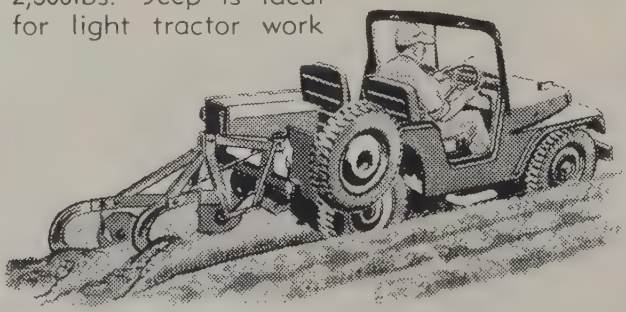

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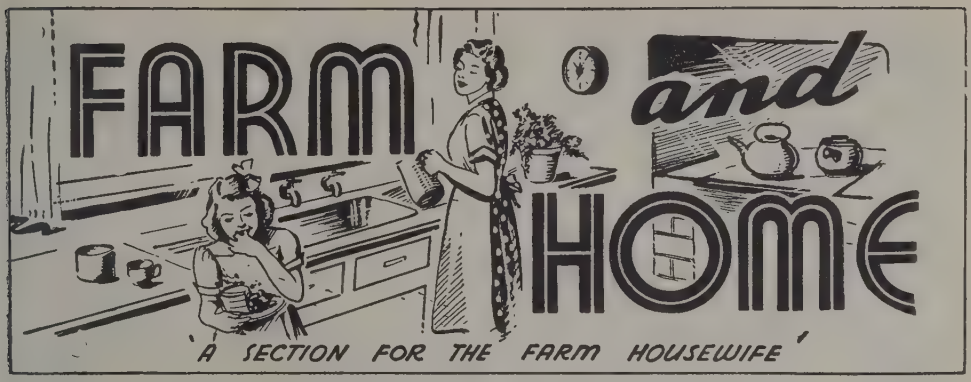

Some on-the-spot Ideas

By BRENDA CLEEVE

THE modern crisp cotton fabrics in a wide range of attractive patterns are cheap to buy and easy to launder, so they lend themselves to many uses in the home. A study of the design often enables the fabrics to be used to better advantage and the popular spotted patterns are outstanding in this respect.

Fabrics with large spotted patterns can often be given extra appeal by the addition of embroidery. This can be carried out in a heavy thread such as soft embroidery cotton. Where this thread is not readily obtainable or if the colour range is rather limited, stranded cotton used in three or six strands makes a good substitute. Knitting cotton may also be used, but here again there is not usually a wide choice of colours.

Plain or patterned fabrics can be appliqued on to the spotted background to give interesting results and haphazard shapes provide variation from the ordered layout of the spotted material. The illustrations show examples of embroidered and appliqued spots on tray-cloths. Worked on black and white spotted material there is an effective contrast for any colour one cares to use.

Cushion covers and many other articles lend themselves to effective decoration in this manner.

PLEATING

Simple pleating can be done very easily on spotted fabrics where the printed design is straight. The cushion cover (illustrated) was made by this method, the pleats being stitched in position with bands of bias binding in this case, although ordinary machine stitching could be used.

At each end, the pleating is released to form a frill, the raw edges being hemmed under or finished with self-toned or contrasting binding.

This cushion cover took one yard of 36 in. material, the odd pieces from the sides being used for the backing. Of course the quantity of material used would depend on the size of the cushion, type of pleating used and the pattern of the fabric.

CHOOSING AND CUTTING A FABRIC

Wherever possible, choose a design in which the spot or pattern is in a definite plan, repeated over the fabric—not a haphazard pattern. This makes the design easy to follow and to match up when joining two or more pieces. This applies particularly where large-spot fabrics are used, as in such cases any errors in matching are very noticeable.

In cutting, try to utilise the pattern in your design. Choose a line that will leave

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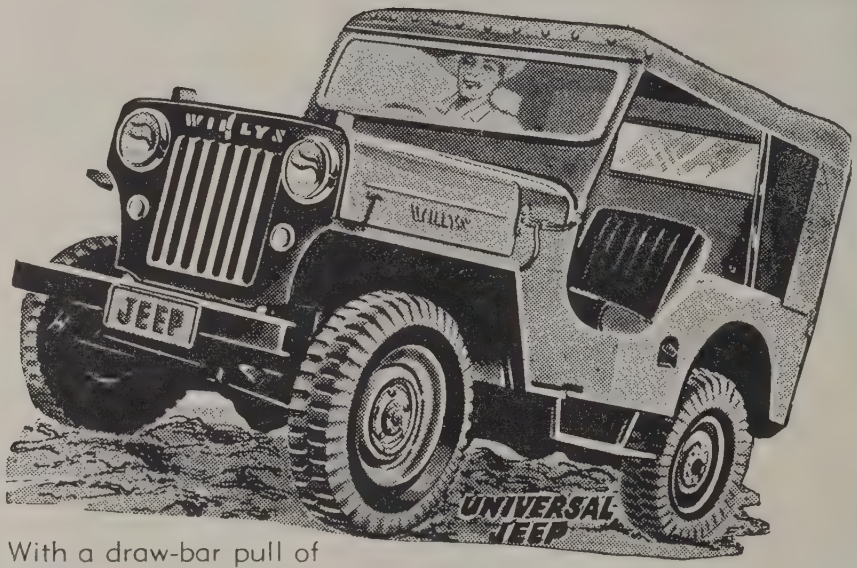

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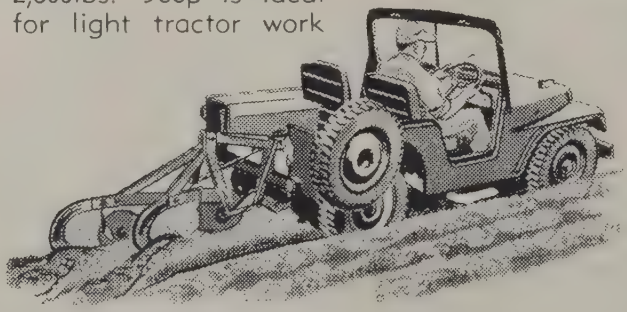

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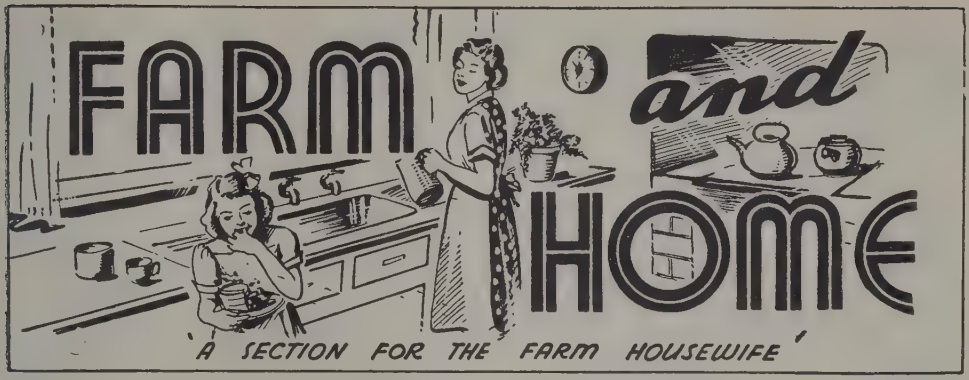

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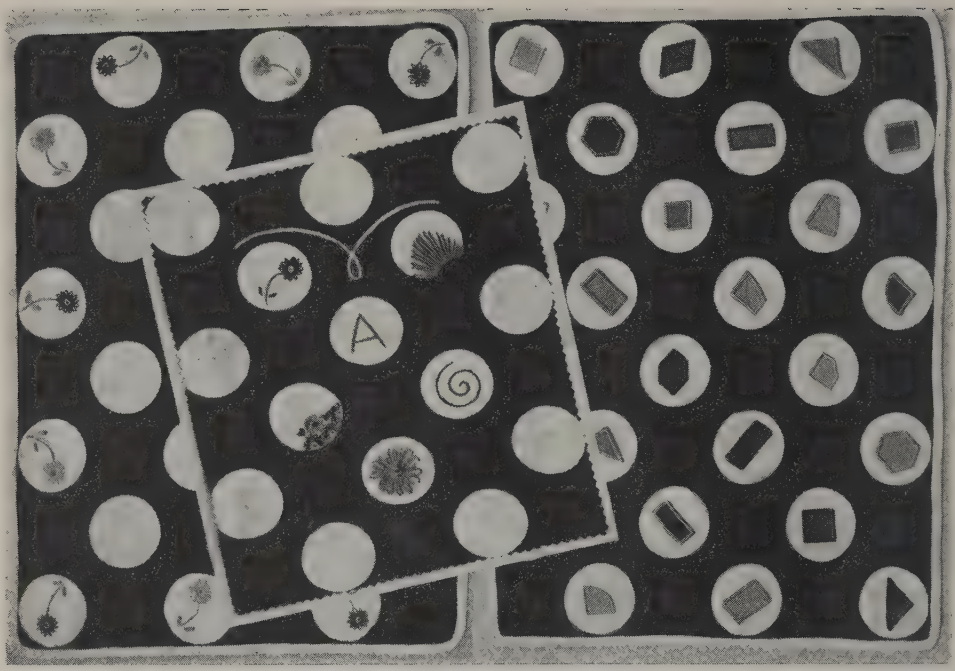

Fig. 1.—Tray-cloths and similar articles can be decorated with embroidery and applique work, some specimens of which are shown above.

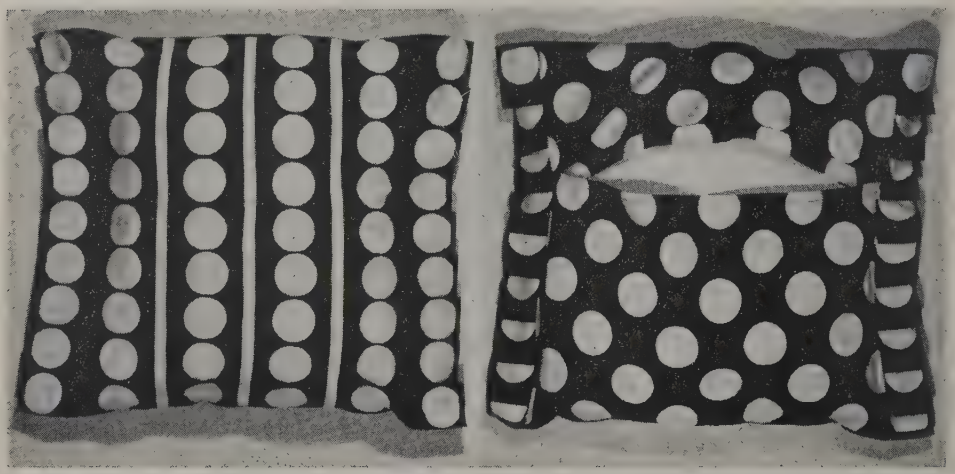

Fig. 2.—Front and back views of a cushion cover in which the spots are brought together in vertical rows by pleating, the pleats being held together by strips of bias binding. At the edges, the pleats are released to form frills.

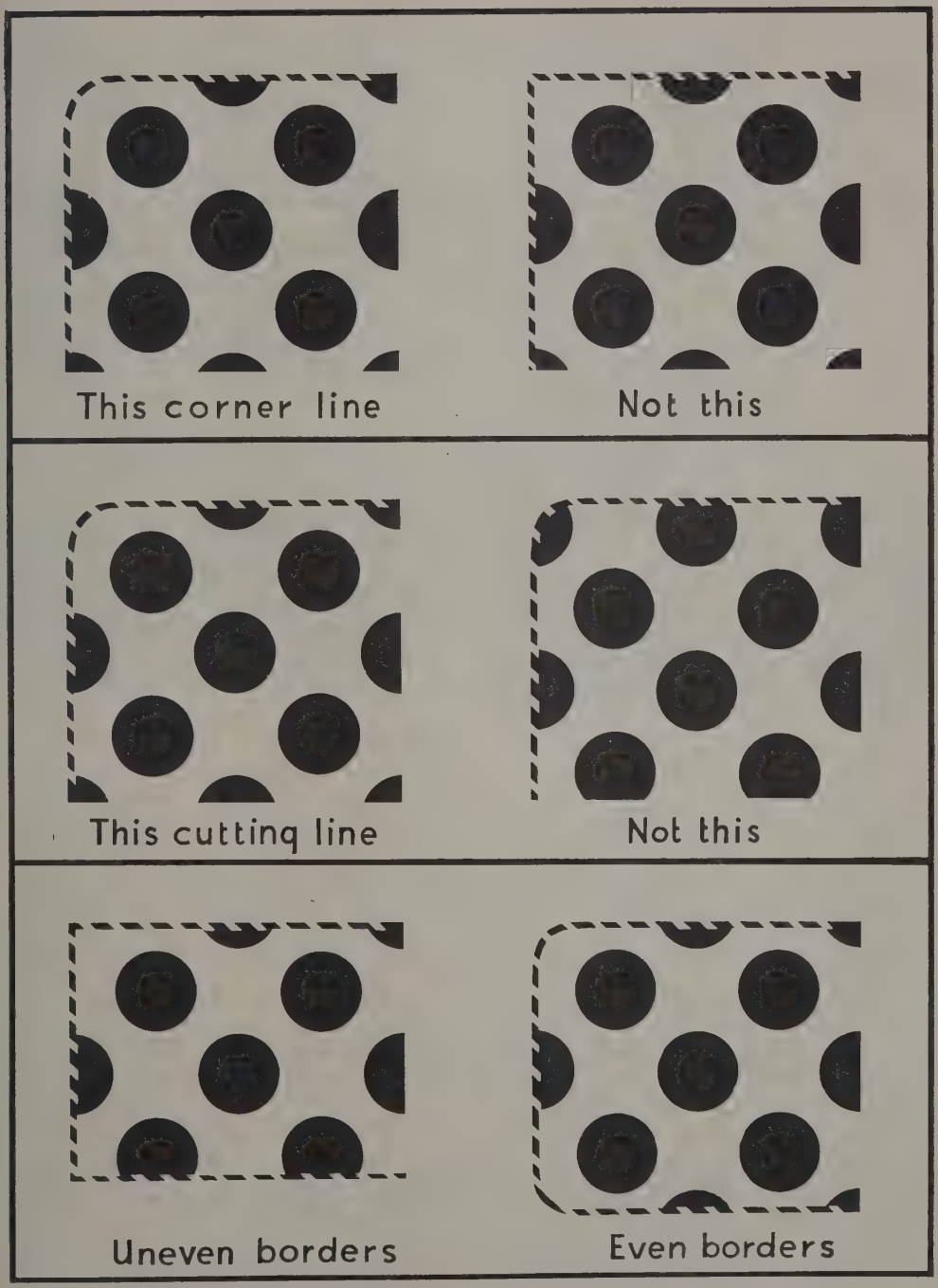

Fig. 3.—Some hints on cutting spotted fabrics.

Fig. 4.—Spotted material with shaped edges is combined with striped material in this apron.

as many as possible of the spots complete and try to keep the borders even, with the same spot pattern on each side. It is not always possible of course, but where it can be done, the appearance of the finished article will be greatly improved.

Corners may often be shaped round the spots whereas with a checked fabric the square corners are usually more effective.

Sometimes a spotted fabric lends itself to a scalloped or shaped edge. The apron (illustrated) has a shaped edge combined with a striped contrasting edging. The shaped edge could be finished with a facing or with bias binding.

Cut the apron as shown in the diagram. The edges of the bib and sides may be finished with bias binding or small hems. The waist edges are gathered in to 7 in. and the straps joined on so that they form a double band to enclose the gathers and then open out to form a single tie.

This is a very simple pattern but one which gives a good fit. It can be made up in a number of fabrics and can be trimmed in countless ways as the apron itself involves very little cutting to interfere with the trimming.

APRON WITH A DETACHABLE BIB

Waist aprons can be converted into work aprons and conversely work aprons can be made to serve as hostess aprons by making the bibs detachable.

Cut the bib 10 in. wide at the top edge, 7 in. at the lower edge and 9 in. deep. The part may be cut double or finished with bindings or hems.

Fig. 5.—Cutting out the apron.

Fig. 6.—An apron with a detachable bib.

The bib can be fastened on by buttons, hooks or press studs—buttons possibly being the most effective as far as fastening is concerned—and when the bib is removed the buttons form a trimming on the waistband of the apron. For this reason a double bib is preferable, as the buttonholes can be worked on this firmer foundation. The buttonholes are better worked in a vertical position to take the strain of the bib.

The apron illustrated was decorated with embroidery done in soft embroidery thread using two rows of herringbone stitch. One row was worked over the other, picking up the spaces between the stitches in the first row. The two rows were then held firmly in place with spoke stitch.

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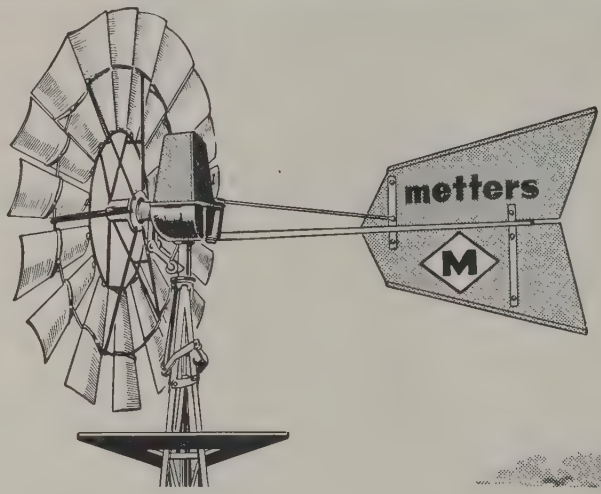

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"PINK-EYE" IN CATTLE

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

A FEW outbreaks of infectious keratitis or "pink-eye" have already been reported among cattle, and it may be expected that many others will come under notice as the summer advances.

The earliest symptoms consist of a copious watery discharge from the eyes which may later become purulent. There is swelling of the eye-lids and photophobia with evidence of pain and discomfort upon exposure to bright sunlight, so that affected animals seek the shade and stand dejectedly with heads lowered and eyelids almost closed. Later the cornea becomes cloudy and opaque, and is sometimes deeply ulcerated. Rupture of the cornea accompanied by a discharge of pus and fluid from the anterior chamber of the eye is not uncommon. One or both eyes may become affected, and depending on the degree of opacity and ulceration there is partial or complete blindness which is sometimes permanent.

LOSS OF PRODUCTION

In beef cattle, there is considerable loss of condition, while in dairy cows, the milk yield is greatly depressed. Without appropriate treatment, several weeks may elapse before recovery occurs, and when a large proportion of the herd becomes affected as is usually the case, a very serious loss of production may result. Recovered animals develop an immunity to the disease and are resistant to reinfection for at least several months. They may however, continue to harbour the infection in their eyes and thus become carriers of the disease. It should be noted that the disease known as contagious ophthalmia or "pink-eye" in sheep, is quite distinct from the eye disease of cattle. These diseases are caused by two different types of infection which are not transmissible from sheep to cattle or from cattle to sheep.

HIGHLY INFECTIOUS

Pink-eye is highly infectious and spreads most rapidly when cattle are herded in close, and direct contact with one another. The bacteria which cause the disease are present in great abundance in the discharges, both from the eyes and nostrils of affected animals, and it is thus possible that the droplets of moisture expelled during sneezing or snorting may infect other cattle. Flies are believed to play a very important part in the transmission of the disease, and the fact that outbreaks are frequent during summer and autumn, and that they seldom occur in winter, would lend support to this idea.

PREVENTION

For the prevention of the disease, the removal of affected animals from the herd immediately the symptoms appear and their isolation in a separate paddock, may be recommended. This should be possible in small herds that can be kept under daily observation, but it would not be practicable under extensive or range conditions, and since apparently healthy cattle which are carrying the infection may be present in the herd, it might not achieve the desired effect. However, where it is applicable, it would seem to be a worthwhile precaution which could reduce the spread of infection.

TREATMENT

For the treatment of the disease, 1% chloromycetin eye ointment is advised. This preparation is now available as a veterinary pack in 1 oz. collapsible tubes and provides an effective treatment at reasonable cost. A ribbon of the ointment

about an inch in length is squeezed onto the tip of the forefinger and smeared inside the lower lid. In early cases two treatments at an interval of 12 hours will effect a cure, but in the more advanced cases repeated application night and morning will be necessary.

Terramycin eye pellets may also be used and are reported to be equally effective. They are supplied as small soluble discs which are inserted into the eye at intervals of 24 hours until recovery occurs. The treatment of dairy cattle which can be bailed and securely held should not present a problem, but with beef cattle which have to be mustered and are often difficult to handle even in a substantial crush, the position is quite different.

Dusting powders blown into the eyes with an insufflator or puff could help to overcome this problem and a veterinary pack containing the antibiotic aureomycin has recently become available, and should be well worth a trial.

Where no treatment is possible the herd should be held in a paddock where there is abundant shade and easy access to feed and water.

In conclusion, I would like to emphasise that early treatment means early recovery and that if it is carried out effectively, this could retard or even prevent the further spread of infection.

(From an A.B.C. Country Hour broadcast.)

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DRY-PICKLING SEED WHEAT

By W. P. CASS SMITH, B.Sc. (Agric.), Government Plant Pathologist

IN Western Australia, seed wheat has, for many years, been dusted before planting with copper carbonate or other fungicides—a treatment usually referred to locally as dry-pickling. This term was first coined when the dry dusting technique superseded the older method of wet-pickling the seed in bluestone or formalin solutions.

Besides being less cumbersome, the dry-pickling method has proved highly effective and bunt or stinking smut of wheat which was formerly so widespread and serious, is now very rare.

Despite this reduction in the amount of bunt, and contrary to the opinion held by some farmers, dry-pickling of seed wheat with an effective fungicide is still very necessary and important economically. Although bunt is quite rare nowadays, it has not been entirely eradicated and in the absence of any seed treatment this disease could soon multiply again and cause heavy losses.

Furthermore dry-pickling of seed wheat is carried out not only for the prevention of bunt but also to control other diseases carried on the seed, and in addition to give some protection from soil moulds which under certain conditions attack the germinating seeds or young seedlings.

This latter trouble, which is sometimes called damping-off may give rise to bare patches or sparse stands and, it is apparently becoming more prevalent under the more fertile soil conditions, brought about by ley farming.

Now, fungicidal dusts vary inherently in their capacity to meet these disease control requirements, and therefore, the selection of a suitable material is a matter of importance.

Hexachlorbenzene, a comparatively new fungicide, was developed specifically for the prevention of bunt or stinking smut of wheat; but while it is excellent for this purpose, it is relatively ineffective against seed-borne spores of flag smut and, it affords little if any protection against soil organisms causing damping-off. For these reasons dusts based on Hexachlorbenzene have not been recommended by the Department of Agriculture for dry-pickling seed wheat.

Fungicidal dusts containing compounds of copper or organic mercury have general purpose qualities and they are preferred to HCB for seed dressing purposes because of their wider range of effectiveness. Until recently, copper compounds such as copper carbonate, were more popular than the organic mercuries, largely because they were cheaper, but at ruling prices the reverse now applies.

There is also some evidence that organic mercury compounds are superior to copper fungicides for protecting the germinating seeds from attack with soil moulds. In an experiment conducted at the Avondale Research Station last season, better establishment of wheat seedlings on old clover ground was obtained from seed treated with an organic mercury dust than from seed treated with copper carbonate.

Organic mercury compounds also have a further advantage, they give excellent control of both the oat smuts and covered smut of barley, whereas the copper compounds are ineffective against these diseases, and may impair the germination of these two cereals.

For these reasons it is recommended that an organic mercury dust (such as Ceresan or Agrosan) should now be used as a standard seed dressing material for wheat, oats and barley, at a dosage of 1½ to 2 oz. per bushel.

To be effective the material must be thoroughly applied, so that the seeds are uniformly dusted and, where this work is carried out by contract, it should be supervised by the farmer to ensure that thorough coverage is obtained.

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Fig. 1.—Steers before being drafted into experimental groups in November, 1956.

MINERAL SUPPLEMENTS FOR KIMBERLEY CATTLE

By W. M. NUNN, B.Sc. (Agric.), Officer-in-Charge, North-West Branch

FOR some years we have felt that in sections at least of the Kimberley cattle region, stock would benefit from a supplement of phosphorus. In his article "More Beef from the Kimberleys," which appeared in 1952 issues of this Journal, Cattle Adviser Grant A. Smith stressed this conviction and referred to trials which would be put in hand using American "Fosfeeder" equipment to meter the right amounts of soluble phosphate automatically into the trough along with the drinking water.

Responses by range cattle to phosphorus supplements have been marked in South Africa, and again in the United States. Many of the dairy cattle in this State are now fed a phosphorus supplement, and trials were therefore deemed highly desirable to test the matter under Kimberley conditions.

Organisation of these trials, unfortunately, turned out to be far more difficult than at first envisaged. Paddocks small enough to contain and control experimental groups of cattle, just don't exist on the Kimberley range, and we, of course, wanted them in particular regions where residual black soil is associated with limestone. Here the calcium-phosphorus ratio is characteristically high and evidence of phosphorus deficiency is all too frequently recorded among stock.

The real work of testing the value of phosphorus as a supplement is to commence this year in a series of paddocks now being constructed for the purpose by Emanuel Bros. at a site specially selected on Gogo Station at Fitzroy Crossing.

Fig. 2.—Six months later (May, 1957). Top picture shows the control or unsupplemented cattle. Note improved condition of the supplemented group in lower picture.

In the meantime, however, Mr. Smith has put his equipment to good demonstrational use in the Broome area and has obtained some results with a composite mineral supplement which are well worthy of publication at this stage.

In the vicinity of Broome is a large area of pastoral country which could be expected to produce prime cattle for the nearby meatworks. The annual rainfall increases from 20 in. south of Broome to over 25 in. in the north and there are considerable expanses of eucalypt savannah carrying a reasonable cover of natural grasses. Where buffel grass has been introduced this has grown vigorously.

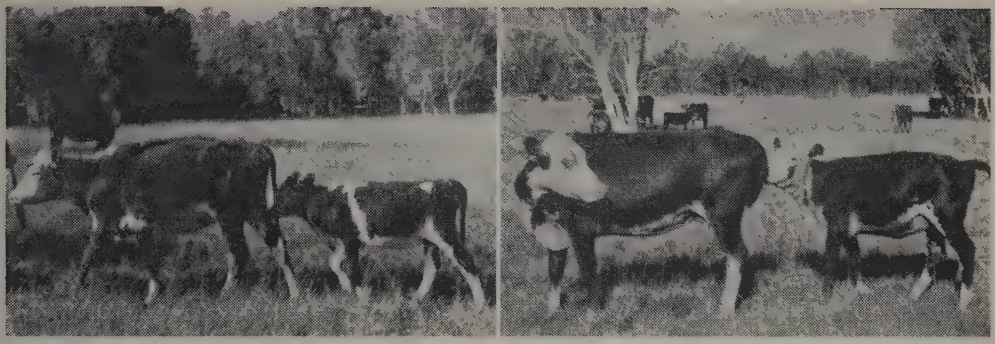

Fig. 3.—(Left) Control cow and calf photographed just prior to rains in February, 1957. (Right) Supplemented cow and calf photographed at same time. All cattle had been on dry feed for four months.

Despite these advantages, however, the cattle produced in the area lack size and quality and, in consequence, there has been no attempt to utilise leases near Broome for the logical purpose of "topping off" cattle. Quite obviously some nutritional shortcoming has limited the productiveness of apparently lush pasture on this country.

CO-OPERATION

Convinced that mineral supplements would go a long way toward correcting the matter, Mr. Smith enlisted the co-operation of Mr. George Harris, of Roebuck Plains Station. Mr. Harris made available two paddocks, each of approximately 1,000 acres in area with separate watering points, together with the necessary cattle and mustering facilities.

It was the unusual circumstance of having two such paddocks available which determined the location of the trial, and it was a splendid example of enthusiasm and co-operation on the part of Mr. Harris that he should be prepared to allot these paddocks—his only paddocks at the time—to this particular cause.

The Department of Agriculture supplied a weighbridge and the Fosfeeder for mineralising the water supply of the supplemented group of cattle.

In September, 1955, the Animal Nutrition Officer (Dr. Snook), visited the area and reported that in his opinion the poor quality of the cattle was most likely to be due to copper deficiency. This opinion is supported by reports of "stringy" wool in Merino sheep and ataxia in lambs. Pasture and liver samples were collected from Roebuck Plains Station and these were found to be very deficient in copper. Dr. Snook commented on the absence of bone-chewing among cattle in the area inspected, despite the presence of bones around watering points. Bone-chewing is a characteristic habit among cattle suffering from phosphorus deficiency. Cobalt

Fig. 4.—(Left) Control cattle in February, 1957, after rains had commenced. (Right) Supplemented cattle at same time.

deficiency is to be expected in most coastal districts of Western Australia and Dr. Snook recommends that cobalt salts should be included in any mineral supplement fed to sheep and cattle in these areas.

Since we were obviously not equipped with paddocks and facilities to deal with several separate determinations, it was decided to run a single trial of one supplemented group versus one unsupplemented group and to include the three minerals copper, cobalt and phosphorus in the concentrate to be metered through the Fosfeeder into the trough, with automatic control from the ball tap.

Underlying the whole approach, of course, was the thought that if the minerals likely to be lacking in the natural feeds could be supplied by simple practical means via the water, which all stock must drink, then these areas in close proximity to the coast and existing meatworks, might be expected to play a more useful and prominent part in the general plan of Kimberley beef production.

The American Fosfeeder used was of rather elaborate and costly design, but a locally-produced mineral supplement metering valve is now on the market which does the job equally well and is available at a price which should ensure its ready sale.

Early plans for the demonstration were rather too ambitious. It was planned to start with breeding cows and to follow through over a period of years, rearing the calves in supplemented and unsupplemented groups after being weaned from their groups of 25 supplemented and 25 unsupplemented mothers. Willing as Mr. Harris was, however, at the planning stage, the task of controlling matings and weanings under relatively make-shift paddocking conditions on a drought-affected Kimberley range, was just impossible, and this part of the trial had to be abandoned despite a promising start.

Photographs are included however, of cows and calves from the two groups, and it will be obvious from these as it was from general appearance of the animals at all stages, that those drinking the "mineralised" water were deriving considerable benefit from it. Although detail concerning ages and weights are not available, it is probably quite significant that at the time of abandoning the trial the supplemented cows had reared 17 well-grown calves, while there were only nine—all relatively small—in the control group.

In November 1956, 106 steers between one and three years of age were mustered from different parts of the open range and drafted into two groups of 53 head. After being weighed these groups were placed, one in each of our two 1,000-acre paddocks—one on normal station water supply, the other on similar water with the supplement of copper, cobalt and phosphorus measured through the Fosfeeder.

At this stage our most important objective was to obtain an estimate of the weight gains which might be expected over one season, from a mob of range cattle introduced to paddock conditions in this country close to the meatworks.

Accordingly, it was decided to forego much of the information we would have liked to obtain in the form of monthly increases, progressive variations in blood phosphorus level, etc., and to disturb the cattle as little as possible between initial and final weighings.

Seasonal conditions were far from good during the six months duration of this trial. Dry conditions prevailed through to February, when the only rain of the season was received. Pastures were dry again by the end of March.

The average gain in weight per head within the supplemented group was 152 lb. between November 4 and May 15, against an average of only 48 lb. within the control group.

Table I sets out group weights and gains, and breaks the groups into subgroups by weight, for further comparison.

TABLE I

	Control	Supplemented
Average weight in lb. 4/11/56	550	599
Average weight in lb. 15/5/57	598	741
Average gain in lb.	48	152
Number of animals over 1,000 lb. at final weighing	....	4
Number between 500 lb. and 1,000 lb.	32	46
Number below 500 lb.	18	2
Total number in final weighing	50	52

It can be clearly seen that the supplemented animals progressed far beyond those in the control group. Their average gain of 152 lb. per head over a six month period in a drought summer with green feed available for little over one month, is far beyond expectations, and it may be that a station placed, like Roebuck Plains, beside the meatworks, could give thought to the possibility of devoting suitable areas to the fattening of steers bred in more distant regions.

It was observed during the course of this demonstration, both with cows and steers, that the animals which received the mineral supplement spent considerably more time grazing than did the controls.

While control beasts camped down in the shade near the water, the supplemented animals grazed well out over the paddock. They seemed to enjoy eating, even when the pasture was at its driest.

There certainly seems to be a case for fitting the mineral supplement valve to waters in the Broome region. Copper in this instance, is probably the most important of the additives, but there are other sections of Kimberley a need for more phosphorus is indicated, and we hope that tests now being planned for several locations, will enable firm recommendations to be made.

AVON OATS YIELD 90 BUSHELS TO THE ACRE AT ESPERANCE

The W.A.-bred oat variety, Avon, yielded 89.8 bushels to the acre in an oat variety trial at the Esperance Plains Research Station. Fulmark, a new variety from the New South Wales Department of Agriculture gave the next highest yield with 76.6 bushels, the mid-season W.A.-bred variety, Dale, gave 62.8 bushels to the acre, and the late-maturing variety, Algerian, gave 53.4 bushels.

The land on which the trials were conducted had not been previously cropped to cereals, but had been under subterranean clover pasture for seven years.

Commenting upon this phenomenal yield, the Minister for Agriculture (Mr. L. F. Kelly), said that Avon oats had been particularly prolific under suitable conditions. The season had been exceptionally favourable to high yields, and the crops at the Research Station had taken full advantage of the heavy applications of superphosphate with copper and zinc together with the build-up of soil fertility resulting from the pasture period.

The land on which the trials were conducted had been cleared by rolling and burning in 1950 and was then fallowed. In 1951 it was sown with Bacchus Marsh subterranean clover and Wimmera ryegrass with 180 lb. of super-copper-zinc mixture to the acre. Since then it had received an annual topdressing with 150 lb. superphosphate to the acre. The pasture was ploughed in May, 1958, and the oat trials planted during the first week of June with an application of 180 lb. to the acre of super-copper-zinc.

Mr. Kelly said that Avon appeared to be a highly suitable variety for the Esperance area. A bulk trial of the same variety yielded 72 bushels to the acre despite some loss of grain through lodging.

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Mineral Supplements for Stock in Pastoral Areas

By L. C. SNOOK, D.Sc., Animal Nutrition Officer

THE herbage available to sheep and cattle in pastoral areas can be deficient in one, or all, of three essential elements, namely copper, cobalt and phosphorus. As far as is known, there is no other mineral element which should be supplied and the use of minerals which are not required can be worse than wasteful—it can be harmful. For example, in restricted areas of Western Australia the natural herbage contains considerable copper. If additional copper is supplied in stock licks or the drinking water this could induce copper poisoning.

Much money and effort is wasted in the treatment of deficiencies which do not exist. Don't jump to conclusions. Before spending money on mineral supplements, endeavour to make sure that there is a deficiency of the mineral it is proposed to supply. Clear-cut diagnosis is not always a simple matter but the following indications may help. If in doubt seek advice from Officers of the Department of Agriculture.

COPPER DEFICIENCY

Sheep.—Merino sheep will not grow good quality wool if the diet is lacking in copper, and "stringy" or "steely" wool is the first and most obvious symptom of copper deficiency. Sheep cannot grow black wool on copper-deficient rations. If a black staple changes to khaki and then to a dirty white this indicates a progressive decline in copper reserves. When copper is supplied to Merino sheep with steely wool, or to a "black" sheep with a khaki-coloured fleece, there can be an immediate change in the fleece staple. This sudden change can be used to diagnose copper deficiency.

Lambs from ewes with copper deficiency will show varying degrees of "rickets" or ataxia. General unthriftiness will result from copper deficiency, particularly in lambs and breeding ewes.

Cattle.—When cattle lack copper, the calves grow slowly and never develop big frames. Yearlings often appear to have abnormally big heads. In older cattle, scouring is a common symptom. Cattle which normally have black hair cannot produce satisfactory black pigment, and faulty colouring of the coat results. Whitish "spectacles" around the eyes of Aberdeen Angus cattle are a characteristic of copper deficiency. Likewise, cherry-red cattle will develop light-coloured "wasty" coats. Unthriftiness and a decline in fertility are to be expected.

TREATMENT OF COPPER DEFICIENCY

Before making copper supplements available make certain that the stock **need** additional copper. In some areas the use of copper supplements could produce toxic symptoms.

In Drinking Water.—Where copper deficiency is severe add bluestone (copper sulphate) at the rate of 1 oz. per 1,000 gallons. **This rate must not be exceeded.** Where the deficiency is mild or marginal 1 oz. of bluestone in each 2,000 gallons of water will suffice.

Copper salts will corrode metals, and bluestone should not be used in galvanised tanks or troughs, unless these have been thoroughly covered with a bitumen paint.

Copper salts are precipitated in alkaline waters such as occur on many station properties. Fortunately the fluffy precipitate is readily stirred up and in actual practice much of this is consumed along with the water. Special copper salts which

are not thrown out of solution by alkaline water can be purchased if necessary.

In Salt Licks.—Copper can be supplied to stock by mixing bluestone with stock salt at the rate of 4 oz. per 100 lb. This can be done by dissolving the bluestone in hot water **in a china jug** and sprinkling the solution over the salt prior to thorough mixing. If sheep eat 2 oz. per week of the salt mixture adequate copper will be obtained.

Cattle are not particularly fond of salt and "licks" are not a dependable vehicle to supply essential copper. Where licks are not readily eaten in the required amount, alternative methods of supplying copper must be investigated.

Supplying Copper Through Plants.—Copper is an essential plant food and healthy pasture will supply all the copper needed by grazing animals. Where this is practical, the logical way to provide copper to animals is per medium of fertiliser put on the pasture. This not only improves the health of the stock but also improves the carrying capacity of the country. Under pastoral conditions consideration could be given to topdressing special "hospital" or "stud" paddocks. A suggested rate of application is 3 lb. of bluestone per acre every three years.

COBALT DEFICIENCY

Lack of cobalt produces "wasting diseases" in sheep and cattle. The characteristic unthrifty appearance is due mainly to a loss of appetite. Young stock are particularly susceptible. Calves and lambs may suffer in areas where the adults appear normal. Cobalt deficiency is most likely to occur in coastal districts but is now being diagnosed in isolated inland areas. Where sheep and cattle suffer from a persistant unthriftiness suggestive of "worms," cobalt deficiency should be considered as a possible cause.

TREATMENT OF COBALT DEFICIENCY

One ounce of commercial cobalt chloride contains ample cobalt for 100 cattle or 1,000 sheep for one week. If the cobalt can be added to drinking water at the rate of one ounce per 10,000 gallons this should ensure an adequate intake of cobalt. Likewise, if 1 oz. of commercial salt is mixed with 100 lb. of stock salt, this will suffice for sheep eating one to two ounces of lick each week.

Cobalt bullets are a very convenient vehicle for the administration of cobalt to sheep under pastoral conditions. Sheep and cattle need a continuous intake of cobalt and neither drinking water nor licks can be depended upon to supply this.

PHOSPHORUS DEFICIENCY

Bone-chewing is the most characteristic symptom of phosphorus deficiency. If cattle do not chew bones it can be accepted that phosphorus alone is not required. In phosphorus-deficient areas the cattle develop harsh coats and tight hides. Bones become fragile and malformed. knobby outgrowths will be seen on the ribs and around the joints. "Stiff-sickness" and injuries to the pelvic bones are commonly seen in the breeding cows. On phosphorus-deficient roughage, stock tend to lose appetite and cease eating herbage which could be expected to keep them alive. This failure of appetite can be particularly serious during periods of drought.

Infertility is a characteristic feature of phosphorus deficiency. In parts of South Africa, for example, it was considered that certain breeds of native cattle would conceive only every second year. When phosphorus supplements were supplied, however, calves were reared every year.

Sheep can subsist for long periods on rations containing very little phosphorus without showing any obvious symptoms of deficiency. It is to be expected, however, that appetite and general productivity will be improved by the use of phosphatic supplements where stock are known to chew bones.

TREATMENT OF PHOSPHORUS DEFICIENCY

No experimental evidence is available concerning the economic returns likely to result from the use of phosphate supplements on pastoral properties in Western Australia. It is known, however, that the dried herbage on which grazing animals have to subsist for many months contains very little phosphorus and symptoms of phosphorus deficiency in cattle have been reported from many properties. Where cattle suffer from phosphorus deficiency

the increased returns which will result from supplementary feeding can be considerable as was shown very clearly by the historic work carried out in South Africa by Theiler and his associates. The following results were obtained in a three-year trial in which cows receiving bonemeal were compared with similar cows on normal veld grazing (Du Toit, 1929.)

Fertility.—The control cows produced 56 per cent. calves. The bonemeal group produced 87 per cent. **Not one** control cow produced three calves in three years, whereas 66 per cent. of the supplemented cows produced the maximum number of calves.

Deaths.—Of 157 cows receiving bonemeal only 14 died in three years (3 per cent. per annum). 61 control cows died (22 per cent. per annum).

Weaning Weights.—Controls averaged 353 lb. while the supplemented calves averaged 409 lb. This difference increased to 33 per cent., at two years of age.

Carcass Value.—Three-year-old steers from the control group averaged 339 lb. dressed weight. The bonemeal steers averaged 597 lb.

There is no doubt that phosphorus supplements will effect marked improvement in phosphorus-deficient cattle. The bonemeal fed in the South African trials supplied about 14 grams of phosphorus per head daily. Methods of supplying 10 grams of phosphorus per head daily are listed hereunder:—

Mono-sodium Phosphate.—This commercial salt is recommended for use in drinking water. It costs £170 ton f.o.r. Fremantle and one ton will supply 10 grams of phosphorus to 100 cattle for 200 days at a cost (including freight) close to £2 per head. Appropriate amounts of the salt could be added at intervals to large holding tanks, or the dissolved salt could be added continuously to drinking water by means of dispensing valves. Ten pounds of the salt would be needed by each hundred cattle every day.

Superphosphate.—This can be added direct to the drinking water so that the water-soluble phosphate goes into solution and the insoluble gypsum sinks to the bottom. Various ways of using the water soluble phosphate in super are described in Departmental Leaflet No. 2243.

About 30 lb. of superphosphate will be required in the water consumed each day by 100 cattle. Superphosphate costs £13 per ton f.o.b. Fremantle or Geraldton. If freight and handling charges double the cost landed on the station, then the daily ration for 100 cattle will cost 7s.

Ground Rock Phosphate.—This is the cheapest source of phosphate, and material from Christmas Island is being used in increasing amounts in stock foods. This product, however, is quite insoluble in water and it must be fed mixed in a feeding stuff or as a mineral lick. Under pastoral conditions there are difficulties which will restrict the use of ground rock phosphate. If it can be used, 2½ oz. will supply 10 grams of phosphorus.

Wyndham "Blood and Bone."—It is possible that this sterilised product will be utilised in the far north to supply protein and minerals to livestock. In tests carried out at the Kimberley Research Station it was shown that range cattle on dry feed will readily eat "blood and bone" mixed with a little salt. Five ounces will supply 10 grams of phosphorus for about one penny. On this basis 100 cows could be supplemented for 100 days at a cost little in excess of £40.

SUMMARY

Copper.

Rate.—1 oz. of bluestone (copper sulphate) in each thousand gallons of drinking water. This is the **maximum** rate and half quantities can be used where the deficiency is not acute.

Amount Needed.—The bluestone given to 100 cattle or 1,000 sheep should **not** exceed 24 lb. in one year.

Cost.—At 2s. 3d. lb. the maximum dosage for 100 cattle or 1,000 sheep will cost £2 14s. per annum.

Cobalt.

Rate.—1 oz. of commercial cobalt sulphate in each 10,000 gallons of drinking water.

Amount Needed.—For 100 cattle or 1,000 sheep for one year—3 lb.

Cost.—At 10s. lb. = £1 10s. per annum.

Warning.—Copper and cobalt salts are precipitated from alkaline solutions: Mineral mixtures guaranteed to remain in solution can be purchased.

Phosphate.—Using Mono-sodium Phosphate.

Rate.—10 lb. in each thousand gallons of drinking water. Each gallon of water so treated will contain about one gram of phosphorus.

Amount Needed.—One ton will supply daily dosage to 100 cattle or 1,000 sheep for 200 days.

Cost.—£170 per ton f.o.b. Fremantle.

Phosphate.—Using Superphosphate.

Rate.—30 lb. in each thousand gallons of drinking water.

Amount Needed.—3 tons will supply daily dosage to 100 cattle or 1,000 sheep for 200 days.

Cost.—£13 ton in new bags f.o.b. Fremantle or Geraldton.

For Use in Feeding Stuffs or "Licks"

Ground Rock Phosphate.

Rate.—2 oz. per cow daily. This contains close to 10 grams of phosphorus.

Amount Needed.—1½ tons for 100 cattle for 200 days.

Cost.—£12 ton f.o.r. Fremantle or Geraldton.

Wyndham "Blood and Bone."

Rate.—5 oz. per cow daily.

Amount Needed.—3 tons for 100 cattle for 200 days.

Cost.—£27 per ton f.o.b. Wyndham.

REFERENCE

P. J. Du Toit (1929): South African Journal of Science, 26, 373.

PRODUCTION IN THE GASCOYNE RIVER AREA

Most people living in Western Australia are aware of the fact that much of our winter vegetable supply is grown in Carnarvon, but few are aware of the actual quantities produced in a small area which extends for 10 miles on either side of the Gascoyne River.

This past season has been a record one due to favourable weather conditions and a good supply of water from the river which flowed four times between January and June, thus assuring growers of adequate supply for the full season.

Bananas have been for many years the major crop in this district, but with the establishing of markets in Adelaide, the runner bean crop is now occupying a more prominent place in the economy of the district.

Last year's production of beans reached a total of 76,000 bags which was considered by many as being close to the limit that could be absorbed by the available markets, but this season 113,000 bags were produced with a very satisfactory return to the growers. Of this large total, 45,000 bags were consigned to markets in Adelaide. This was in some way assisted by the introduction by the Government of bean grading regulations at the request of the growers. These regulations were in force this season so that a high quality product was landed in Adelaide at all times, and over-sold beans from other States by 3d. to 10d. per lb.

With the export of only best quality beans to Adelaide a relatively higher number of lower grade beans were sold in Perth, at naturally depressed values. However, many growers claim to have netted an average of £2 to £2 10s. per bag over the whole season.

In addition to bananas and beans a large range of other vegetables are grown to suit seasonal markets in Perth. The following table lists each variety and total production since May 31, 1958:—

Bananas	21,200 cases	Pumpkins	2,000 bags
Runner Beans	113,000 bags	Egg Fruit	580 bags
Tomatoes	43.000 cases	Peas	400 bags
Cucumbers	12,000 bags	Chillies	250 bags
Capsicums	3,200 bags	Onions	26 bags
Rock Melon	2,600 crates	Papaw	73 cases

These figures represent production to November 30, 1958, and bananas, pumpkin, rock melons and capsicums are still being consigned to Perth.

Produce is transported to Perth in large, covered, semi-trailer trucks and this season at times as many as six of these vehicles have had to be used to carry produce for one market. Loading is carried out in Carnarvon on Mondays, Wednesdays and Saturdays; the produce is sold in Perth two days later.

A large proportion of this production is grown under share-farming agreements. Many of these share-farmers return to Carnarvon annually and after the season enjoyed this year will perhaps bring many others with them next season.

LINEN FLAX IN WESTERN AUSTRALIA

Fig. 1.—Retted flax "gaited" for drying

By H. G. ELLIOTT, Assistant Superintendent of Dairying*

FLAX as an economic crop has a fairly brief history in Australia and a much shorter one in Western Australia. The earliest records show that it was first grown near Geelong in Victoria in 1863 and in South Australia at Hydock in 1870. Early attempts to grow flax economically were not very successful and it was not until 1935 that any major progress was made. Flax Fibres Pty. Ltd., established a small flax-growing industry in Victoria but the outbreak of World War II necessitated a much more rapid expansion in Australia than was ever anticipated and the Commonwealth Flax Production Committee took over all growing and processing in Australia.

In Western Australia, linseed flax was first grown in 1905 at the Narrogin and Brunswick State Farms. Further experiments were tried in 1918 but were not very successful as only one variety, "Blue Riga" was tested. In 1939 the first major experiment with linen flax was carried out at the Research Station, Denmark, with a number of varieties obtained from the C.S.I.R.O., Canberra. Liral Crown, which at that time was the main variety grown by Flax Fibres Pty. Ltd., in Victoria, yielded well, giving good straw length and fibre quality.

With the outbreak of World War II, flax-growing in Australia for the production of fibre became essential to assist in supplying the forces' needs in the United Kingdom and Australia. Russia was the main source of supply of flax for the United Kingdom prior to the war, and at the outbreak of war the United Kingdom became dependent for her supplies of flax on Belgium, Holland, France and Northern Ireland. With the overruning of Western Europe by Germany the supply position became serious and the United Kingdom asked Australia, New Zealand and Canada to grow flax and shipped the initial seed to these countries. This seed mainly consisted of the white-flowering variety "Concurrent" which was obtained from Western Europe just prior to the German occupation.

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Western Australia was asked to co-operate in this effort to produce flax and in 1940 the Australian acreage went to 20,692, of which 980 were planted in this State. Today, Western Australia is the only State in Australia growing flax, with the processing being done by a privately-owned concern, the Blackwood Flax Co-operative Co. Ltd., at Boyup Brook.

During the early part of World War II an endeavour was made in this State to establish linseed as a commercial crop with the variety "Punjab" but the attempt failed, as this variety was severely affected with rust and also attacked by climbing cutworms. Further attempts have since been made to establish the linseed industry using the rust-resistant variety, Walsh. Some success has been achieved in recent years in the medium rainfall areas of the middle and lower Great Southern and South Coast.

The fibre flax plantings in 1940 were late-sown (July-August) in the coastal areas between Waroona and Dardanup and although most crops were attacked by climbing cutworms encouraging results were obtained and some 600 tons of straw were supplied to the mill at Yarloop.

As it was necessary to increase the acreage in Australia in 1941 further areas were explored and two new centres were established at Donnybrook and Boyup Brook. Some 6,200 acres were sown in the three districts. All three mills were then dew-retting straw. By 1942, 8,730 acres were planted, this being the maximum area planted in any one year in this State.

In 1944 the Yarloop Mill was closed and in 1947 the Beelerup Mill near Donnybrook ceased to function, leaving the Boyup Brook Mill as the only one operating in this State.

During the period 1940-45 all straw produced in this State was dew-retted and on an average about 6 per cent. fibre on original weight was obtained. This method was wasteful due to inability of controlling weather conditions. Apart from that, it was much more costly in manpower than the present system of controlled hot water retting in concrete pits.

In 1945 a battery of eight pits for controlled hot water retting was installed at Boyup Brook and much higher yields—up to 9.5 per cent. of line fibre—was obtained by this method.

The Flax Production Committee of the Commonwealth Government decided in 1949 to offer for sale all its mills and depots in Victoria, South Australia and Western Australia—the three flax-growing States at that time. The only mill sold by them was the one in this State. It was purchased by the W. A. Government for the Blackwood Flax Co-operative Co. Ltd., Boyup Brook.

During 1943 there were 34 flax mills and depots operating in Australia as follows—Victoria 18, South Australia 4, Western Australia 3, and Tasmania 9.

The setting up of the Flax Commission in place of the Flax Production Committee took place in 1950 and this body controlled the growing and processing of flax in Victoria (7 mills) and South Australia (1 mill) until the growing in these States ceased in 1958. It is now anticipated that all mills under the Commission's control will finish processing before the end of 1959 when the Commission will then cease to function.

DESCRIPTION

Flax is the fibre produced from the flax plant (*Linum usitatissimum*) which is a slender annual growing to a height of 1 ft. to 4½ ft. with blue-purple or white flowers. It is a vegetable fibre of bast classification being one of the most valuable and useful vegetable fibres produced in the world, as it is superior in strength and quality to cotton, and will produce a finer fabric.

Owing to the fibre having great tensile strength and durability it is used in the manufacture of such commodities as heavy sail-cloths, canvas, twines and threads, nets, finest writing and cigarette papers and insulating fabrics. During the war it had many uses in the three services. Apart from the fibre produced by the plant, surplus seed is of value for the production of linseed oil and meal for stock feed.

The original flax plants were grown for both seed and fibre but from this, over many years, two main types have been segregated, one for its height and fibre, and the other for linseed only.

Fig. 2.—Tying gaited flax after retting and drying

THE FIBRE

As mentioned earlier, flax is a bast fibre produced as an intermediary layer between the outer cover or bark and the inner stem of the plant stalk. This layer is held by a gummy substance which makes extraction difficult. It is the breaking down of these gums or pectins by retting or rotting which frees the fibre from the woody material of the stalk so that the beaters of the scutching turbine can separate them.

HISTORY OF FLAX-GROWING

Flax goes further back in history than any other present-day commercial fibre. The earliest cultivated flax was one known as *Linum angustifolium,* which was a much smaller plant with fewer and narrower leaves then the present day flax plant, and was also a perennial.

This variety was known to have been cultivated for fibre and manufactured into various articles by the Swiss lake-dwellers in the Stone Age period. This variety still occurs, growing in its wild state, in many parts of south and west Europe and south-west Albania and Asia.

The Egyptians grew, and used flax, thousands of years ago and the Babylonians carried this use on to a fairly high state of textile development. Three thousand years ago the Phoenecians extended the culture, and the Greeks, together with the Romans, made it into a household industry.

During this period the variety used was *Linum usitatissimum,* the variety which is now grown commercially throughout many parts of the world. It is still found growing wild in the districts between the Persian Gulf and the Caspian and Black Seas. The early use of flax fibre was for the making of lines and nets for fishing as well as catching wild animals, also for the woven fabrics worn by many peoples of the ancient civilisation. It was used for such purposes as tapestries and the wraps for embalming bodies, as linen was found in the tombs of many of the ancient Egyptians.

At the present time flax is grown in nearly every portion of the temperate zones of the world, and the most important areas where it is cultivated are in the Baltic countries of north-west Europe,

Fig. 3.—Closer view of the tying operation

and also in Denmark, Holland, Belgium, France, England and Ireland, as well as in Canada, the United States of America, Mexico, Japan, Australia and New Zealand. Some is grown in Kenya and in portions of South America, and very good flax has been and still is being grown near Archangel in Russia.

PRODUCTION OF FLAX

Before World War II the Soviet Union produced over two-thirds of the world's crop, the bulk of which was consumed in Russia for home production of linen articles. The rest was grown throughout Poland, Germany, Belgium, France, Holland and Latvia. Practically none was grown in any other parts of the world except a little in Ireland and England.

Practically all the flax used in pre-war Britain was imported. In the early 1930's the Soviet Union was the largest exporter of flax but this export rapidly dropped during the latter part of 1930. During that time Belgium, Holland and France became the main suppliers to Britain.

Most of the Dutch and French flax was prepared in Belgium, prior to export, as the latter country had developed far more favourable conditions for the treatment of flax by improved methods.

During the earlier parts of the War when these countries were overrun by Germany, supplies had to be produced by other countries throughout the world and it was then that the Australian Government was asked to assist in this production.

FLAX-GROWING

Climate.

It is generally recognised that the most suitable conditions for the growing of flax are a cool climate, having sufficient moisture during the growing period with a relatively long ripening period between flowering and harvesting. Any form of excessive water-logging during the winter months will have detrimental effects on the growth of this crop but late spring rains together with winds can also have a bad effect when heavy crops can be lodged and tangled.

The incidence of heavy storms, and hail are particularly dangerous during the latter period of growing but it is generally considered that the climatic conditions in the south of this State are suitable for the growing of flax.

Soil.

Profitable crops have been grown in this State on a variety of soil types, but it is generally recognised that the best soil for high-yielding crops is a well-drained loamy soil which overlies a clay subsoil. Very high-fertility soils are not necessary for the production of good linen flax crops, as these tend to create a quick-

Fig. 4.—Carting dried and retted flax

growing, tall, rank crop which frequently tends to lodge. The straws from such crops can be coarse and of low fibre yield.

Poor low-fertility soils are unsuitable, since the crops grown on them have a tendency to be too short, low-yielding and uneconomical to harvest. It is recommended that flax can be grown as a rotation crop to pasture and cereals. On old pasture land, however, it is suggested for best yields that a cereal crop be grown the year prior to planting the flax crop.

It is not good practice to sow flax on the same land for more than two years in succession as there is a tendency for a build-up of rust and other diseases to occur. On a heavy loam with very high fertility, three excellent crops have been produced in succession in the Boyup Brook area, but nitrogen, potash, zinc and phosphorus can be the limiting factors for good growth.

Diseases such as are experienced elsewhere which cause "flax sickness" in the ground are not known to exist in this State. The fungus disease *Fusarium lini* which causes what is known as "flax wilt," has not been recorded here.

Soil Preparation.

To obtain the best results a good soil preparation is essential. Prior scarification and then the ploughing of the land with a mouldboard plough are recommended, and the area should then be left in a short fallow for a period of about two weeks, after which it should be cultivated down without turning up the ploughed-over sod.

Compacting and harrowing a number of times is essential to obtain the fine smooth seed bed required for the best results and germination. Control of weeds by good cultivation prior to planting is essential, and this also gives control of such pests as lucerne flea and red mite. Where land has a tendency to be cloddy, slugs can cause a considerable amount of damage during the winter months.

Every care must be taken to select well-drained land for flax growing; water-logged soils are detrimental and frequently heavy growth of water weeds will occur.

Time of Planting.

Once the land has been well prepared and is ready to receive the seed, the best time to plant is from mid to the end of May under most seasonal conditions. If heavy early June rains do not occur, seeding can frequently be carried out into mid-June particularly on soils which are fairly rich in nitrogen. It is not generally recommended to plant very early as frequently insufficient preparation of the soil to control weeds and pests takes place.

Apart from that, early sown crops on most soils have a tendency to become too tall and liable to lodge.

Method of Planting.

The standard method has been to drill in the seed with the fertiliser using a grain drill. Cross-drilling is sometimes carried out, but recent experimental work indicates that best yields and results are obtained by semibroadcasting the seed. This is done by pulling the hoses out of the shoes of the drill and dropping the seed and fertiliser behind, using light drill harrows to cover the seed.

Rate of Seeding.

The standard recommendation is at the rate of 72 lb. per acre. This can be varied slightly with the varieties and with the variety "Wada" lower rates are recommended. Experimental work carried out over the last few years indicates that slightly higher rates up to 90 lb. per acre with some varieties may be an advantage when semibroadcasting is practised. Care should be taken to see that the seed is not planted too deep—¼ in. to ½ in. is ample.

VARIETIES

For many years in this State, Concurrent has been the major variety grown. Many other varieties have been tried but rust has been one of the limiting factors for the growth and yield of these.

A number of new varieties have been produced which have been resistant to races of rust occurring then, in this State, but new races of rust have occurred and attacked many of these varieties. At present the popular varieties are Concurrent, Wada, Boyup and Currong all of which are susceptible to one or more races of rust, but generally not severely enough to cause extreme damage to the crop every year. A new unnamed rust-resistant variety D83, Selection 2112, bred in this State (as were Wada and Boyup), is now being bulked up for seed, to sow larger areas and to determine its fibre recovery and value.

FERTILISER

From 1 to 1½ cwts. of super-zinc fertiliser is recommended to be sown at time of seeding. Under light sandy soil conditions and where potash is known to be a deficiency 1 cwt. of muriate of potash is recommended. On practically all soils where flax is grown in Western Australia, nitrogenous fertilisers are not required as generally flax crops are grown in rotation with oats or clover. Frequently, on the better soil types which have been under clover pasture for a number of years, it is better to grow a crop of oats first, as if sown to flax excessive growth takes place which gives a tall crop, liable to be coarse-stemmed and subject to lodging badly with unsuitable weather conditions during the late spring.

PESTS

Red-legged earth mites and slugs are the two main pests responsible for reduced yields of straw in this State. Lucerne fleas can also cause damage, and climbing cutworms have been responsible for heavy losses in crops after flowering time by causing not only the lowering of yields but loss of seed and damaged straw.

Red Legged Earth Mite. *(Halotydeus destructor.)*

Before control measures with insecticides were available control was by clean farming and a short fallow period. Today sprays or dusts containing DDT and Malathion or similar substances are used prior to or after seeding with excellent control results. It was estimated that prior to insecticide control up to 10 per cent. loss of seedlings occurred annually, and hundreds of acres were completely lost yearly apart from the general thinning out of crops.

Slugs.

These generally only affect crops on heavy soils left cloddy. Baiting with a methaldyhyde or similar preparation is recommended for their control.

Lucerne Flea.

These do not generally cause much damage but where present on late-sown crops they can be controlled by using one of the sprays containing Parathion or Malathion or a similar compound.

Climbing Cutworm. *(Heliothus armigera.)*

During the early war years climbing cutworms caused considerable damage. Many crops were totally deseeded and in

Fig. 5.—Flax mill at Boyup Brook

some cases the straw was badly damaged with the result that poor quality short fibre was obtained. Control measures by using 2 per cent. DDT dust brought about a change in this trouble and whenever an outbreak is suspected control measures can be adopted by using sprays or dusts containing DDT.

DISEASES

Rust.

This is the most important disease of the flax plant in Western Australia. It was first recorded on cultivated flax in South Australia in 1889 and during World War II it was one of the contributing factors towards the abandonment of flax production in Tasmania. Both leaf and stem rust occur in this State. Where heavy infection of the leaves takes place without much damage to the stem, serious reduction in yields of seed and premature ripening of the straw will occur. Where the stems are badly affected, a serious reduction in the yield and quality of flax fibre occurs.

This disease has been known to cause complete failure of crops in all stages in this State and the earliest stage in which crop failures have occurred is when the plants were in the vicinity of 9 in. high. Less severe infections later in the season can reduce yields by about 25 per cent. The spores or seeds of rust are the reproducing bodies of the fungus and are mainly wind-borne. Rust is a disease which is very difficult to control and the only satisfactory method of attack to date has been by endeavouring to breed new varieties of flax which are highly resistant to this disease.

Unfortunately a number of rust races of flax occur in Australia and it would appear that new races of this fungus are produced from time to time. In an endeavour to overcome this rust trouble in flax in 1946, Dr. A. J. Millington, then Plant Geneticist of the Department of Agriculture, selected a number of plants from a paddock which was severely affected by rust in the Donnybrook area. The seed of this was subsequently bred up and finally a new variety produced which was named Wada.

As far as can be determined the basis of this new variety was Riga Crown, which first originated in the Baltic States Subsequently, this variety, Wada, was

Fig. 6.—Retting tanks

found to be affected by another race of rust. Later another rust-resistant variety was bred by the Department of Agriculture in Western Australia and this was called Boyup.

Boyup had a much better fibre quality with a more erect growing habit, and was less liable to lodging than Wada. Later, unfortunately, this variety was attacked by a further race of rust. Today, these two varieties together with Concurrent and a Victorian variety Currong, form the basis of the varieties which are grown commercially in this State.

Zinc Deficiency.

This was first identified in Western Australia in Murradup in 1942 and Donnybrook in 1943. Control measures were quickly found from work which had been carried out in South Australia, and zinc applications with superphosphate were recommended to overcome this disease.

Generally, the disease was more serious on the lighter sandier soils but many of the heavier soils throughout the flax growing districts in the State at that time were affected. The disease was commonly known as "die-back."

If zinc oxide at the rate of 2 to 3 lb. per acre is not used now when planting this crop, reductions in yields and quality of straw can be from 10 to 100 per cent. according to the severity of the deficiency in the area.

Calcium Deficiency.

This has occurred in odd areas throughout the flax-growing districts but not in sufficient size to warrant control measures being taken. From 1 to 2 tons of lime applied to the soil at the time of planting controls this disease.

Flax Wilt.

Throughout most of the flax-growing portions of the world this is a very serious disease as when infected, plants wilt and die at any stage of growth.

Generally it can be said that the most dangerous aspect of this disease is that it is seed-borne and once in the soil will remain there for many years. Up to date, this disease has not occurred in this State as every precaution has been taken to prevent its entry.

Stem Breaking or Browning.

This is a fungus disease which attacks the plants through the cotyledon. When severe it can cause the collapse of the stem close to the soil level. It also causes a blight on the leaves, stems and buds which appears shortly before harvesting.

This stage of the disease is called brown rot. Where it does occur, it substantially lowers the quality and quantity of fibre

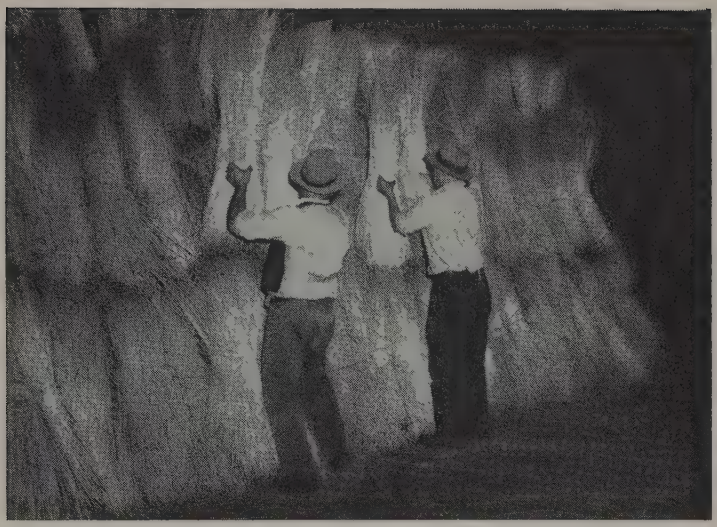

Fig. 7.—Loading the retting pits

as well as the seed yield. To date the disease has not occurred on the commercial crops in this State.

WEEDS

The most serious weeds in flax are the tall growing species such as thistles, wild radish, wild turnip, and wild oats as it is difficult to remove these from the sheaves during the processing of the straw for fibre. Good cultivation prior to sowing is essential to reduce and control weeds. Short-growing butt weeds can frequently be removed from the sheaves during deseeding operations but where crops are pulled, these are generally left in the field as the pullers operate above the line where the butt weeds occur.

In the earlier stages a heavy incidence of weeds in a flax crop is very serious as flax is slow-growing and consequently not a good competitor.

Many methods have been tried for controlling weeds in flax crops and some success has been obtained with growth-prohibiting types of weedicides. If these are applied when the flax crop is around 4 in. to 8 in. high, the waxiness of the leaves and stems of flax at this stage, prevents absorption of weedicides and the crop is not so susceptible to damage.

Where heavy weeds occur not only in the butt but throughout the sheaves, much greater costs occur at the mill in processing and consequently the producer receives less per ton for his straw.

TIME OF HARVESTING

It must be recognised that when the flax crop is grown for fibre it should be harvested before it has reached full maturity. The time to harvest is when the crop is at the stage when the first bolls in the centre of the plant are brown with some seed rattle and approximately three-quarters of the leaves on the stem have fallen and the stems are still sappy. The stems at this stage should be of a golden yellow colour. The time for harvesting in this State is that period between the end of November and late December. This can vary according to the district, season and the varieties grown.

METHOD OF HARVESTING

In practically all countries throughout the world harvesting of the fibre flax crops is carried out by pulling, either by machine or in some parts by hand. During the earlier periods of the history of flax in this State the binder was used for harvesting. This was in a similar manner to that of harvesting oaten or wheaten hay and this practice was adopted as a standard one for many years, as most of the farmers in the flax growing areas had reaper binder machines of this type and as it was only necessary for the farmers

mechanism removes the seed bolls from to make minor adjustments to the machine to enable them to switch over from hay cutting to flax cutting. In the last three years in this State an alteration in the method of harvesting has taken place as a number of the most modern European flax-pulling machines have been imported by the co-operative company and it is anticipated before long that the bulk of the crops will be harvested by machines of this type.

These machines pull and bind the crop ready for stooking and are capable of operating at speeds of up to eight miles per hour and pulling up to two acres per hour under ideal conditions.

Heavier yields per acre are obtained by the farmers with pulled crops and the mill obtains crops which are reasonably free from butt weeds. Apart from this, previously many of the crops which were too short for cutting are now harvested, as when pulled they make sufficient length for economical processing at the mill.

Crops under 24 in. in length cannot be handled economically by the flax mill and crops which exceed 40 in. in length are not generally considered economic as they yield fibres which are too long for easy handling by the spinners.

STOOKING

The normal method for stooking for hay is generally adopted with flax. However, it is recommended that long stooks should be made, not large round ones, as better curing will take place.

It is essential that when handling a flax crop every care is taken not to damage, or create tangling or loss of straw during these operations.

The better the crop is handled in the field and during cartage the greater will be the recovery of fibre at the mill.

CARTAGE

Flax cartage is carried out by contractors with motor trucks or farmers with their own trucks. Here again it is essential that every care be taken with the straw during the handling and carting operations. The straw, on delivery at the mill is weighed, and the farmer is then paid according to the assessment, which has been made in the paddock prior to him being advised that cartage to the mill be proceeded with.

PROCESSING

In Western Australia, the farmer is responsible for the growing, harvesting and cartage of the flax crop to the mill. Frequently the flax processing company provides pullers or binders at contract rates and arranges contract cartage to assist harvesting and delivery operations.

Once the flax straw is valued in the field, carted to and weighed at the mill, it then becomes the property of the company. It then may go immediately into stack, or to the deseeding plant for processing and when deseeded go either to stack or the pits for retting, after which it is then gaited for drying, finally stacked or carted to the scutching machine, this all according to what seasonal operations are taking place at the time.

Cartage from the farms can only take place during fine weather and when the straw is efficiently cured so that stacking or deseeding can take place immediately it is received at the mill.

STACKING

Undeseeded straw which is to be processed before the winter is stacked in the open according to farmer crops and straw quality, so that the identity of it is not lost at the mill. Original straw which is to be held over to the following spring before processing is stored under the cover of large sheds capable of holding over 2,000 tons.

DESEEDING AND WINNOWING

As the new season straw arrives at the mill, that which can be handled through the deseeders is processed and then either stacked ready for future treatment or immediately retted. The amount handled per day is limited to the throughput of the deseeding machines which at present can handle up to 85 tons per day. Soenens types of machines which can be either stationary or mobile are used at present for this purpose until the new mobile deseeder is installed. The sheaf bands are cut and the straw then fed into the deseeding machines uniformly. Combing

Fig. 8.—Feeding flax straw into the scutcher

the straw and on cut straw removes the butt weeds and short straws from the butt end. The straw is then mechanically re-butted and tied with twine again. Short straws and weeds are baled for packing material and the seed and bolls passed on to the scalper and then to the winnowing machines for crushing the bolls and separating the seed from the boll chaff.

The boll chaff, together with immature seed, is then passed on to a hammer mill where it is hammered into a pollard. This is readily sold as a basis for stock feed as it contains about 10 per cent. protein but is rather high in fibre and fat.

The bulk seed obtained is then passed on to cleaning machines which separate out a number of seed lines ranging from first grade sowing seed to commercial seed which is then sold for linseed oil extraction and the production of linseed meal. Weed seeds are hammer-milled into a meal and find a ready market as a basis of stock foods.

RETTING

This is a process of rotting, of which there are many methods in use in various parts of the world. The process can be carried out by what is known as "dew" retting or hot or cold water methods, and even by chemical means. However, at Boyup Brook a system of controlled hot water retting is adopted.

To understand the process of retting it may be wise to describe the structure of the straw.

It consists of—

(1) The skin which is an outer layer of cells.

(2) A ring of fibre cells or bundles which are held together by pectins which are gummy substances.

(3) A central cylinder of woody material which is ultimately known as shive when beaten from the fibre by the scutcher.

Retting can be by either bacterial or fungal action and in water retting it is by bacteria which is normally present on the straw. With the controlled hot water system the process takes from 96 to 110 hours for the pectins and gums to be broken down sufficiently. Once this action has taken place the straw is then taken out, gaited and dried, ready for scutching.

At the mill there is a battery of eight tanks each capable of holding up to 10 tons of dry straw. These were installed in 1944.

Once filled, the tank of straw is first given a rinse for seven to eight hours with water at a temperature of 73° to 75° F. This rinse removes much of the highly soluble materials from the straw. These materials could retard the retting process if not taken off first. The second or retting water is then pumped in at a temperature of 85° to 86° F. and during

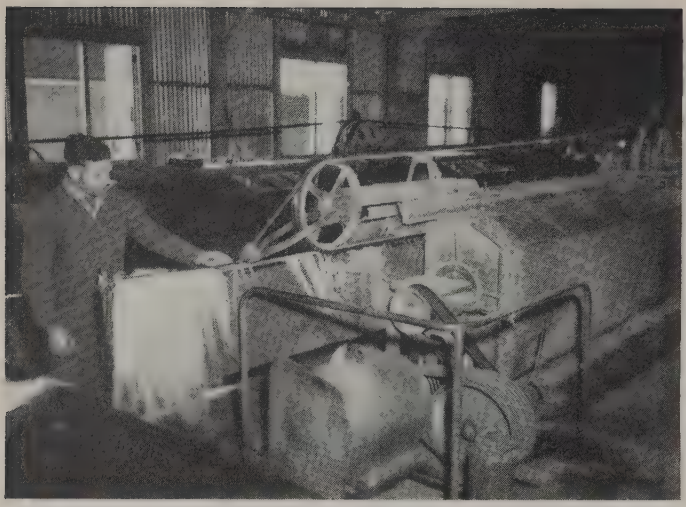

Fig. 9.—Taking line fibre from the scutcher

the retting period the temperature is gradually increased by about 4° F. every 12 hours until 95° F. is obtained. When retting is completed the tank is drained and straw left in it for three to four hours before taking it out to the paddocks for gaiting and drying. It takes about 30,000 gallons of water to ret each tank of 10 tons of straw. For best results, good quality water is essential.

SCUTCHING

This is a process whereby the shive or woody material is separated from the fibre in the retted straw.

A modern scutcher has a prefeeder and a series of fluted breaker rollers with two turbines for beating the woody material from the fibre. It is necessary in this process to see that the straws are parallel and well butted, prior to entering the breakers of the machine so that a maximum recovery of long fibre will be obtained with a minimum of tow or short fibres which are of much lower value. Good, well-handled straw can give up to 15 per cent. recovery of line fibre from its original weight. Owing to improvements with processing machinery and efficient methods of handling and protecting the straw, the recovery of fibre on original weight at the local mill has increased from 9 per cent. to 11 per cent. over the last two years and with further improvements now under way higher average recoveries should be possible.

GRADING

This starts to take place from the time the line fibre is removed from the scutcher. The fibre is then "dressed" put up into "stricts" finally into "bundles" and baled and branded ready for export to the spinning mills. During the "dressing" operations "pluckings" are obtained and these are baled also, for sale.

Short fibre known as "tow" is collected from below the machines and is baled for sale to spinners.

The woody material or shive is blown to the furnaces where it is burnt and thereby assists in reducing the amount of boiler wood used for heating water for the retting process.

FLAX PRODUCTS

From the foregoing it can be seen that a number of products are obtained from the flax plant. They are, in the order of value—

1. **Line Fibre.**—The final and most valuable product of the mill, which brings prices according to grades ranging from £250 to £300 a ton. Prices of up to £380 have been obtained.

2. **Seed.**—For sowing seed and for linseed oil extraction and meal. Seed for oil extraction is sold at about £70 per ton.

3. **Tow.**—This consists of short fibres not fully cleaned which are sold for various prices according to their quality on a clean shiver basis.

4. **Pollard.**—Hammer-milled seed bolls and immature seed used for stock food and sold readily for this purpose.

5. **Winnow Refuse.**—Also sold for stock food.

6. **Soenons Waste.**—Short straws and weeds from the butt ends of the straw frequently sold for packing purposes.

7. **Shive.**—Used for fuel for heating water for retting, otherwise burnt as waste.

Much experimental and breeding work has been, and still is, in progress in this State to endeavour to produce straw free from blemish and capable of producing a high percentage of high quality fibre.

Apart from that, every endeavour is being made to increase the yields of straw obtained per acre by the farmer. Consequently it is anticipated that within the next two or three years a great improvement can be expected both on the farm and in the mill.

Since the author's trip overseas when investigations were made into the flax industry there, it was obvious that in Australia, certain new techniques had been developed mainly from principles used elsewhere, but many of the standard practices used overseas could be further tried here, even though it is recognised that the crop overseas is sown in the spring and harvested in the autumn which is the reverse to what happens in this State.

Some of these practices designed to raise the yields per acre and to improve the quantity and quality of the fibre, are now being tested. They include closer row spacing, heavier rates of seeding, use of potassic fertilisers and trials with other varieties to assist in obtaining stronger standing straw which is less liable to lodging under adverse weather conditions.

It is essential that the average yield of straw per acre must be lifted as it is only about half the yield of overseas countries where 3 to 4 tons are obtained per acre.

As mentioned previously, greater consideration should be given to better methods of harvesting and more efficient handling of the crop both on the farm and on delivery at the mill if the maximum extraction of line fibre is to be obtained. Mechanical pulling instead of cutting has many advantages in that the farmer obtains heavier yields, no stubble is left to be got rid of and from a disease point of view, control is better, as little or no straw is left on the field to carry diseases over. Apart from this the mill obtains a sheaf free of butt weeds, thereby reducing the amount purchased, as at present a 5 per cent. tolerance of weeds is allowable.

With regard to the breeding programme being carried out by the Department the major aim is to develop a rust-resistant variety with a satisfactory fibre content and grade, from 400 to 500 selections and introductions which are being grown on an experimental site at Boyup Brook. Apart from this work, pure lines of seed are being maintained of the varieties Boyup, Concurrent, Liral Crown, Wada and Currong. This work also includes the introduction of newly-released varieties of flax from overseas and of crossbred materials from Victoria, together with the selections from varieties and development of new varieties by hybridisation.

It is considered that this research programme will be a very important item in assisting the maintenance and production of the flax industry in this State.

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MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1961 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1961 entrants is made after the Junior results are available early in 1960.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1960.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity).

(b) Junior Standard Bookkeeping.

Should places still exist for 1961 commencement after the preliminary selection early in 1960, they are filled in order of application during 1960, by qualified applicants.

Some places still exist for 1960 commencement and are now being filled by qualified applicants, i.e., those who have or are now taking the correct course at Sub-Leaving or higher standard.

Duration of Course.—Two years.

Fees.—Approximately £130 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

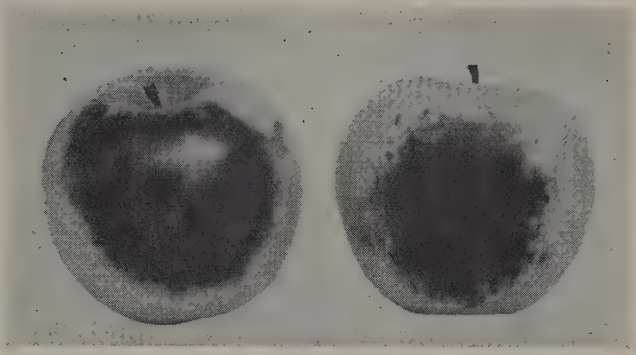


Fig. 1.—Severe sunburn scald —a shiny brown to ebony black discoloration limited to one face of the apple

The Storage of the Granny Smith Apple

By F. MELVILLE, B.Sc. (Agric.), Senior Adviser (Fruit)

THE Granny Smith, since its introduction into Western Australia about 1914, has had a very decided influence on the apple industry in this State. It has for many years now been the main variety and at present is approaching 50 per cent. of plantings. The general age level is considerably below that for the other important varieties and with its domination of new plantings in recent years production can be expected to increase considerably at the expense of the other varieties, particularly Cleos and Dunns, and some of the red varieties. The annual production has been as high as a million bushels in a heavy year.

The reasons for the popularity of the Granny Smith are not difficult to find. Under Western Australian conditions the trees grow well, crops are heavy and the fruit usually attains good size with little thinning. Harvesting may be spread over a relatively long period and with its dual-purpose nature and long storage qualities it is the popular choice of growers. It is well-liked on the local market and overseas importers pay premium prices.

It is sought after in Singapore, in the United Kingdom and also in Scandanavian countries and by virtue of the absence of black spot and codling moth in Western Australia, fruit of a high quality can be shipped.

The Granny Smith has certain characteristics which make for easy handling. It has a tough skin, a thick waxy coating which resists moisture loss better than most varieties and a slow rate of ripening which permits harvesting over a relatively long period. These features coupled with a capacity for long storage have resulted in some laxity with the result that Granny Smiths are often not handled or stored to the best advantage. No matter for what purpose the fruit is required, better results are obtained if the correct procedure is adopted. For long storage proper handling is essential.

The commercial harvesting of Granny Smiths commences before mid-March for the Singapore trade and concludes by about mid-May, the May pickings being mainly for immediate sale on the local market. The bulk of the fruit is picked in April. Although harvesting may be spread over two months the extremes should be avoided except for specific purposes. Early-harvested fruit is usually immature, more liable to bitter pit and very subject to superficial scald and, therefore, is only suitable for limited storage. On the other hand, Granny Smiths picked late, that is early May, are forward in colour and maturity and par-

ticularly after rain, are very subject to bruising. This fruit is ideal for immediate sale on the local market but should not be stored for lengthy periods.

SCALD

The most serious problem associated with the cool storage of Granny Smiths is their susceptibility, under Western Australian conditions to scald. Scald is a physiological disorder which develops in cool store and while not affecting the soundness of the fruit it seriously affects its saleability. There are two main types of scald.

Sunburn scald, as the name implies, develops on the surface of the apple which has been exposed to the direct rays of the sun and usually shows some sun injury as a yellowing or browning of the skin at the time of picking. In cool store the discolouration deepens in colour and may eventually develop a shiny ebony black appearance (see Fig. 1). This occurs quite early during storage and is often prominent by July.

No means has yet been found of controlling this disorder but experiments have shown that there is a tendency for the condition to be less severe in later harvested apples.

SUPERFICIAL SCALD

The second type of scald is known as superficial scald. It is essentially a problem with long stored fruit and appears in increasing amounts in apples stored from September onwards. The first evidence of the disorder may be apparent as early as July but is not a serious problem at that time. The disorder develops rapidly from the end of October onwards. Superficial scald appears as a dull brown skin discolouration, irregular in shape, usually slightly depressed and prominent at the calyx end of the apple. In severe cases it can involve the majority of the skin surface (Fig 2.)

Superficial scald will occur more on fruit growing in the protected parts of the tree or on the shaded side of the apple. At times an apple will develop sunburn scald on the exposed surface and superficial scald on the sheltered side. Fruit produced under good growing conditions is also usually more subject to superficial scald than that grown under harder conditions.

The severity of the disorder varies from year to year according to the weather conditions, hot summers with high light intensity being the worst.

Although scald results from low temperature storage the discolouration may not become prominent until the apples have been out of store for several days. Fruit which comes out of cool store in apparently good condition may be badly scalded before it reaches the consumer. The uncertainty of what may happen to fruit showing evidence of scald in the market, limits the price offered by buyers.

CONTROL OF SUPERFICIAL SCALD

Since 1950 a series of detailed trials have been conducted to obtain information on the factors involved in scald development and find means of control. These experiments have proved highly successful so that it is now possible to make definite recommendations for commercial control.

The earlier results of these trials were published in Vol. 2 (Third Series) 1953, of this Journal and reprinted as Bulletin 2033.

Time of Picking.

The maturity of the fruit at harvest is the basic factor determining its susceptibility to scald. Experiments conducted over a number of years have shown quite conclusively that superficial scald is a disorder of early picked fruit. As the apples mature, so the liability to scald decreases.

This is well illustrated in the following results obtained in 1957 with Granny Smiths stored at 32° F. until November.

Date of Harvest.	Percentage of Fruit Developing Scald.
3/4/57	91.0
15/4/57	51.1
24/4/57	3.0

Granny Smiths harvested at the beginning of April are very susceptible and almost 100 per cent. of the apples picked at this time may eventually scald if stored at a temperature in the vicinity of 32° F. As the fruit matures there is a gradual

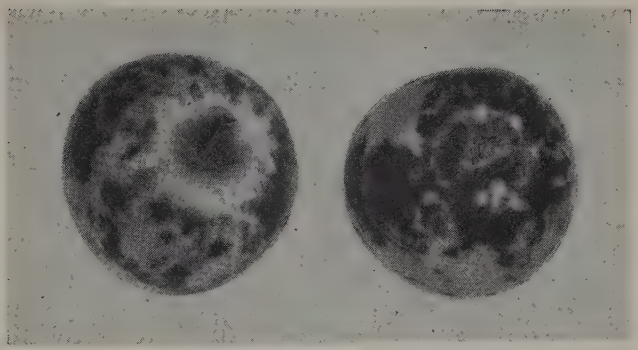


Fig. 2.—Severe superficial scald—dull brown irregular skin discoloration slightly depressed and prominent at the calyx end

decline in scald, although the disorder may still develop quite seriously in apples picked after mid-April. During the latter part of April the fruit appears to undergo some functional change which vitally affects the physiological process responsible for the development of scald during storage. This change which normally appears to occur between April 21 and April 25, marks the end of the danger period for scald. It is influenced by seasonal effects on maturation. All Granny Smiths picked before about April 25 can be regarded as scald-liable and should be treated accordingly.

As a general guide it is recommended that Granny Smiths for long storage should be picked between April 10 and 25, the season, the district and condition of the trees being taken into account in determining actual harvest dates. Fruit picked earlier will have poorer dessert quality and runs a distinct risk of scalding. If it must be harvested and cannot be disposed of immediately, storage should be terminated by the end of August.

Handling.

It has been common practice in the past to hold Granny Smiths loose in picking boxes in the shed for a period of a week or more before packing as a measure for controlling scald. While experiments have shown that under certain circumstances some benefit can accrue in this direction, generally the practice has nothing to recommend it. The effect on different lots of fruit is rather unpredictable and where the shed storage is of short duration—say one week or less—there may be an increase rather than a decrease in scald. A longer period appears to be more effective but the adverse effect on the storage life and quality of the apples which results, more than offsets any benefit from reduced scald which can be better controlled by other means. The best procedure is to cool store the fruit as soon as possible after picking.

Oil Wraps.

Oil wraps are used in Western Australia for all Granny Smiths packed either for export or storage. While for highly-susceptible fruit, oil wraps alone do not give satisfactory control of superficial scald, in conjunction with new methods of storage which will be discussed later they are very useful. A high oil content is necessary for maximum effect.

Under certain limited conditions Granny Smiths have been stored successfully unwrapped. This is discussed later after the question of storage temperatures has been considered.

Storage Temperatures.

Trials were commenced in 1950, to investigate the role of storage temperature in the scald problem. As the result of this work a practical means of controlling superficial scald has been developed.

The results have shown quite conclusively that superficial scald is a low temperature disorder and susceptible fruit stored continuously at 32° F. is certain to scald. Over 90 per cent. of apples picked at the beginning of April have consistently scalded by October in each year. Fruit harvested later has produced less scald but invariably has been worse at 32° F. than where modified temperature storage involving higher temperatures was used.

Early in these trials it was found that a very significant reduction in scald was obtained by storing the apples initially at a higher temperature. Holding the apples wrapped in oil wraps at 40° F. until the end of May before dropping the temperature to 32° F. gave good results and promoted a more detailed investigation of the times and temperatures in this initial period which would give the best control. Temperatures of 36°, 38° and 40° were used and periods varied from two to nine weeks. As the outcome of these investigations it has been established that a temperature of 40° will give the greatest control of scald. The period required at this temperature varies with the time of picking but generally extends to about the end of May. In some years 38° F. is adequate for the initial temperature extending over the same period. Temperatures lower than 38° do not give sufficient control to be commercially useful. At 40° the effect on colour is greatest and for this reason 38° may be preferred. However, the difference is not very great.

In some years, scald is much easier to control than others but as these years are very hard to predict with certainty, uniform recommendations have been made based on the requirements over a number of years.

Most of the experimental work was conducted with apples harvested at the beginning of April to ensure having fruit of high scald susceptibility. Apples harvested at the recommended stage for long storage would be less liable to scald.

It is recommended that for Granny Smiths picked within the scald-susceptible period and required for other than very short storage, Modified Temperature Storage be used. This entails storing the apples directly after picking in a chamber with temperature variations maintained within the 38°- 40° range. At the end of May the temperature is dropped to 32° and maintained at this level for the remainder of the storage period.

As an alternative procedure where it suits cool store practice the initial temperature of 40° F. may be dropped to 36° after four to five weeks and to 32° F. at the end of May. This method gives very good control of scald.

In years of high scald susceptibility such as 1958, complete control may not be obtained by temperature means alone. To obviate undue losses from scald the fruit should be examined at regular intervals from September onwards. Where signs of superficial scald are found it will pay to remove a small sample and keep it at room temperature for several days for further examination. Relying on instore inspection alone is dangerous as scald can develop very quickly out of store particularly late in the year so that apples taken out in apparently satisfactory condition can be badly scalded by the time they are offered for retail sale.

One characteristic of Granny Smiths stored by one of the Modified Temperature methods is the extreme waxiness developed by the fruit. Dessert quality is also superior to that of apples stored at 32° F. This is particularly noticeable in the case of early picked fruit.

Ex cool store there is no great difference in colour between apples stored by Modified Temperature methods and at 32° F. continuously. After a week out of store the difference is more marked but is insufficient to affect commercial values.

D.P.A. WRAPS

As a result of investigations carried out by Professor R. M. Smock in the United States of America, a new chemical has been found which is extremely effective in controlling superficial scald. Experiments conducted in this State have confirmed that wraps impregnated with the chemical Diphenylamine (DPA) will provide good control although some scald may develop in early picked fruit. During the 1958 season in which scald was particularly severe, apples picked at the beginning of April did develop some scald in DPA wraps when stored at 32° F. although very much less than similar fruit in oil wraps. Where DPA. wraps were used in conjunction with Modified Temperature Storage complete control was achieved. At the present time diphenylamine has not been released for commercial use but is being subjected to toxicological tests.

UNWRAPPED

Wrapping in oiled wraps is essential for the main crop of Granny Smiths. Oil wraps must be used for export fruit and are necessary for long storage. However, Granny Smiths harvested late in the season, i.e., after about April 25, have been successfully stored loose without wrapping for a reasonable period.

Trials conducted over two years have shown that the fruit may be stored unwrapped with negligible loss from scald until the beginning of September provided it is held at 38°-40° until the end of May before reducing the temperatures to 32°. With continuous storage at 32° although the scald will be very much less than for earlier harvested fruit it can be greater than commercially desirable.

The loose storage of Granny Smiths may be useful in enabling the last of the crop to be harvested within reasonable time while the fruit is still in a satisfactory condition for storage. It can also obviate the delay in cool storing these apples due to the inability of the packing shed to handle the fruit within a reasonable time and further more spread packing over a longer period thus easing the peak load on the shed.

It must be emphasised, however, that the indiscriminate storing of unwrapped Granny Smiths without proper safeguards will lead to serious losses from scald.

SUNBURN SCALD

In some ways sunburn scald is more serious than superficial scald in that it develops earlier, it can affect export and so far no means has been found of overcoming the problem except by rigidly excluding all apples showing evidence of sun injury when packing. There is some evidence that later-picked fruit is less subject to sunburn scald but this does not provide a practical means of control. Apples showing little visible sign of sun injury may develop quite severe sunburn scald so that careful grading is required if sunburn scald is to be eliminated.

SENESCENT BLOTCH

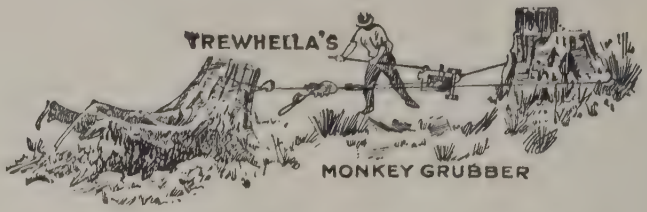
When the Granny Smith is nearing the end of its storage life it will often develop a blotchiness of the skin. This olive green to brown discoloration usually on yellowish green background is known as Senescent Blotch and is an indication that the fruit has been stored too long. A browning just below the skin at the stem end also points to overstorage. The apples should be watched carefully late in the storage season and marketed while the fruit is still in good condition. The normal storage life of Granny Smiths is usually over by the end of November. Under some circumstances the fruit will retain its appearance longer but the dessert quality will be imparied.

RECOMMENDATIONS FOR STORAGE OF GRANNY SMITHS

1. Store only sound fruit of good quality.
2. Harvest at the right stage of maturity for the purpose required. Where long storage is involved pick between April 10 and 25.
3. Cool store with a minimum of delay.
4. Rigidly exclude sunburn from fruit required for export or for storage after July.
5. Use oil wraps for all stored fruit except that harvested late and required for limited storage.
6. Modified Temperature Storage should be used for all apples required for extended storage except that fruit picked after April 25 and wrapped in oil wraps may if desired be stored at 32°.
7. **Don't Overstore.**—Keep a close check on the fruit in store and remove at the first sign of senescence. Samples removed from time to time will indicate the scald position.

ACKNOWLEDGMENT

Acknowledgment is made of the very helpful assistance given by a number of growers in enabling fruit to be obtained from their properties, to Departmental officers who assisted with the preparation and examination of the fruit and the various cool stores who made storage facilities available. In the latter stages of the trials special experimental chambers provided by the W.A. Meat Exports at Robbs Jetty free of charge made the detailed work on temperatures possible.



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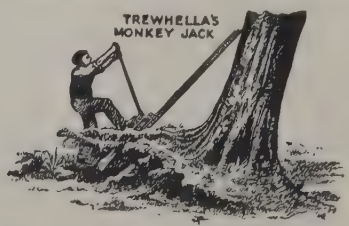

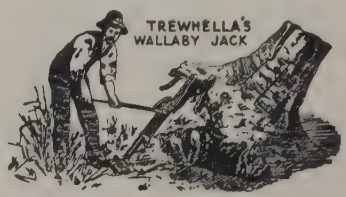

CURRENT EXPERIMENTS WITH VEGETABLE CROPS

By T. WACHTEL, Agricultural Adviser, Horticultural Division

THE purpose of this talk is to give a brief and general outline of the experimental work carried out by the Vegetable Section of the Department of Agriculture this year. Some of these experiments were started years ago, the trials this year being, as it were, just a further step in a series. Some other experiments which were started this year, will be followed by further steps next year, and perhaps several years after. Experiments very seldom yield final results in one season.

Two potato fertiliser trials which were planted out this year, one at Manjimup and the other at the Vegetable Research Station in Perth, are a further step in a series of trials of this kind that have been carried out over the last three years. The previous experiments have given reasonably good indications as to the requirements of this crop for major plant nutrients. The work is carried one step further this year, partly by testing these requirements on another soil type, that is, on sand under sprinkler irrigation, and partly by testing the best time of fertiliser applications. The ultimate aim is to determine the best fertiliser mixture and the best method of its application for all the important potato-growing districts of the State. When the results of several experiments are analysed and compared, due regard will be paid to economic considerations, that is, it will be attempted to give recommendations which will result in highest net profit, not merely in highest yield. It is important to bear in mind that highest yield and highest net profit are not necessarily coincident. In fact, they very seldom are.

Another experiment which has been conducted for several years and is continued again this year, is a series of potato variety trials. Most of the varieties tested had been developed in the Eastern States and released to growers in recent years. Some others have been grown on a commercial scale for a long time. From previous experiments here, it appears that there are at least two varieties which show promise, and may eventually compete with the local Delaware variety, regarding both yield and quality.

Onions are another major crop with which experiments of increasing scale have been commenced this year. In the past few years, many varieties were tested, some imported from the Eastern States, some others from the United States of America. None of these varieties proved suitable to our growing conditions. The major aim of these trials was to find a variety of better keeping quality than our locally-grown onions. Poor keeping quality is one of the major problems connected with the onion industry in our State, resulting in considerable financial losses year after year. It appears, however, that there is no easy solution to this problem. Several experiments have been carried out in the last three years with a chemical called Maleic Hydrazide applied as a

spray to the crop shortly before harvest. This chemical has been successfully used in many parts of the world, and it is reported that it prevents sprouting in storage. However, our experiments gave rather poor results, probably due to the low solid content of bulbs when grown in sandy soils and heavily irrigated. Nevertheless, it will be tested again this year, using stronger concentrations and applied at different growth stages of the plants.

Another attempt to improve our local onions is the commencement of a line selection and breeding programme this year. It is a frequent experience that a crop grown from locally produced seed shows a lack of uniformity with respect to size, shape and colour. The reason for this is quite simple. Onions are pollinated by insects, and when seed is produced in gardens situated in close proximity to each other, the crossing of different types is inevitable. Bulbs which were of desirable appearance were selected from commercial crops last year, and are now planted out at the Vegetable Research Station to produce seed. Each individual plant will be self-pollinated this year, and the progeny tested next season. From the progeny, several selections will be made again, and the work carried out in this fashion until a pure line of desirable characters will be produced that can form the nucleus of a variety which has adapted itself to local growing conditions. It is rather a long-term project, but a very important one.

A new method of onion production is also being tested this year, perhaps the first time in Australia, although it is widely practised in Europe and America. With this method, the crop is planted with, what is called, dry sett instead of seedling. The dry setts are produced by planting onion seed very thickly. In a close stand the plants will compete for light, water and nutrients, and the bulbs will not develop to full size, but remain small, about one-half to five-eighths of an inch in diameter when fully mature. A very large number of these small onion bulbs can be produced on a small area. When mature, they will be lifted from the soil, cured and stored for next season. Instead of planting seedlings the next season, these dry setts will be planted at normal planting distance, and the bulbs will develop to full size, producing a normal commercial crop. Several advantages are attributed to this method. The crop planted with dry setts matures several weeks earlier, thus occupying the area for a shorter time. They are not generally subject to, or rather resist more successfully, the attacks of root maggot flies. But the main advantage is that the setts can be planted mechanically and hence reduce labour costs. It would be too early to make predictions concerning the success of this method in comparison with the one used at the present by commercial growers.

As it was pointed out at the beginning, this brief account was not intended to be more than just an indication of the type of experimental work being carried out with vegetable crops. Time does not permit me to give details of all the experiments done with over 30 different vegetable types. Another point which I wish to emphasise again, is that it generally takes several years of very exacting work before final recommendations can be given.

PEDIGREE SEED PLANTING

By H. G. CARISS, B.Sc. (Agric.), Regional Agricultural Adviser

BREEDERS of all types of stock will pay fabulous prices to obtain what they consider to be the best animal for their own particular studs. They do this with the avowed object of improving the quality of the stock as well as their chances of obtaining better prices for animals of their own particular breeding. With cereal crops and pastures, it is just as desirable and necessary that best quality seed be used.

Throughout the world, various organisations go to great pains to produce seeds of a very wide range of plants, which have been subjected to exhaustive procedures to ensure that the ultimate product is not only what the buyer asks for but is also of the highest quality. In this State the Agricultural Department has for many years,

been certifying subterranean clover seed. The label carrying the endorsement "Government Certified Seed" is a warranty to the buyer that the seed sold is true to name and purity.

It is very necessary that a cereal producer maintains the purity of his seed stocks, as admixture indicates inefficiency and can lead to difficult harvesting, lower yields, and reduction in quality. It is desirable, therefore, that all growers should, from time to time, procure seed which is of pedigree stock, that is, seed which has been bred from the right strains and selected to produce superior types of seed, free from admixture and extraneous material.

Breeding of pedigree cereal seed, in this State, has been a major activity at the research stations in the cereal and sheep areas since 1912. At two stations in particular, Merredin and Wongan Hills, there are special staffs concerned with the breeding, selection and production of the foundation or "pure line" seed stocks used for planting the stud and bulk areas on the stations. Over the years, thousands of bags have been supplied annually in small lots.

The pedigree seed production system briefly is that each year at harvest, single plants are selected from the current pure line rows. These are the most prolific and true to type, and are retained for planting next year's pure line rows. The balance of the grain is bulked and sewn in an accumulation plot. The grain obtained is distributed to various stations for planting their "stud" plots. The following year the seed obtained is used for the bulk areas from which the farmer obtained his supplies. By means of this system the farmer is able to obtain seed which is virtually the product of the selection of single plants from a single seed.

By obtaining this pedigree seed, the farmer can establish his own stud plots and maintain the purity and vigour of his own crops.

This year the demand for the varieties available—ten varieties of wheat, five of oats, two of barley and the early "Merredin" strain of Wimmera ryegrass—has been heavy and the limit for varieties to each applicant is likely to be only a bag or two.

THE RUAKURA ROUND FARROWING HOUSE

By P. BECK, Field Assistant, Dairying Division

SOME 20 to 25 per cent. of all pigs farrowed die before weaning and 50 per cent. of these deaths occur in the first week after farrowing, which is the most critical period in the pig's life. Such high losses should not be tolerated, for every time a pig dies on the farm it means a lowering of the net income to the farmer.

Preweaning death in young piglets is not altogether inevitable, for a great majority of the mortalities experienced are within the jurisdiction of preventive control by the farmer in most cases by simply using a little foresight and ingenuity in his management methods.

There are two predominant and closely-linked aspects to be considered in reducing baby piglet losses during the birth to weaning period. They are the care and husbandry of the pregnant sow and the provision of adequate, warm farrowing-house facilities. Both, because of their very close relationship are of great importance, and the efficiency with which they are managed must be of an equally high standard.

Briefly, the objective is to keep the in-pig sow in a healthy, firm and trim condition and towards the end of the gestation period she should be on a rising plane of nutrition, to ensure a sustained and high milking capacity after farrowing and to avoid overfatness which is predisposing to the overlying and trampling of baby piglets.

In general, losses may be attributed to three main causes, namely infections at, or shortly after birth; chilling with a subsequent loss of vigour; and overlying or trampling by the sow.

The conventional type of farrowing house of square or rectangular plan, together with modifications such as the addition of hover boards and artificial

heating has met with varying success in reducing piglet losses, but has not proved highly successful in this aspect.

The most recent development in the endeavour to design a practical, easily-managed farrowing house affording maximum protection to newly-born pigs, is the Ruakura round farrowing-house designed in New Zealand.

The Ruakura pen consists of an exterior circular wall of good insulating material, usually concrete, with a doorway; inside is a semi-circular wall set seven inches off centre towards the front of the pen. The remainder of the inner circle is made up of guard rails which allow free movement in and out by the young pigs, while keeping the sow out. It is over this safety zone that an infra-red ray lamp can be set up if so desired, giving the young pigs a centrally-heated area in which the danger of trampling or overlying is eliminated.

Because the central hover or safety zone is off-centre, and owing to the curves of the farrowing rail and guard rails the sow can only lie in one position and this is such that her udder is facing, and in close proximity to the safety zone. The young piglets therefore, have only to move a very short distance to suckle, thus affording them a maximum of protection.

At present the most controversial point regarding the round pen is roof design, and this requires careful consideration in the erection, as it is a major factor in temperature control within the pen. This is especially important in some of our areas where a wide variation between day and night temperatures is experienced. At Ruakura, many types of roof design are being observed in an endeavour to arrive at the most suitable type, which, in easy operation may be manipulated for air circulation control, to ensure as near as possible, the optimum 65° to 75° F. temperature range within the pen.

I would now like to give some figures indicating the relative reduction in piglet losses in the round pen compared to losses in the conventional type.

At Ruakura where the pen was designed, losses have been cut from 8 per cent. to ½ per cent. and comparable results are being obtained on commercial pig-raising establishments in New Zealand. At Roseworthy in South Australia losses which were formerly in the vicinity of one pig per litter have been cut to the extent of only six losses in 40 litters.

Denmark Research Station in our State is experiencing only one-eighth of the piglet losses incurred in the conventional pen, by using the round type, and Muresk Agricultural College reports greatly reduced losses in their four pens of this type.

It is obvious from these results that the Ruakura round farrowing pen is worth considerable thought by any enterprising pig raiser who is endeavouring to reduce piglet losses to a minimum.

HOW THE RANDOM SAMPLE LAYING TEST COULD AFFECT THE POULTRY INDUSTRY

By R. H. MORRIS, Officer-in-Charge, Poultry Branch

FOR many years now, day-old pullet chicks have been retailing at about £15 a 100 and from the interest which breeders and hatcherymen are taking at the present time in breeding better stock I would say there is every possibility of the chicken buyer being asked to pay a good deal more for his chicks during the years ahead.

Hatcherymen are likely to increase their chick prices and I am of the opinion that the average chicken buyer will be more than pleased to pay these higher prices.

To suggest that people will, within a few years, be happy to pay upwards of £18 a 100 for sexed pullet chicks, when we know very well how hard it is to extract even an extra 10s. a 100 from most chick buyers today, might to some people, seem a fantastic proposition and one not worthy of further consideration.

But just a minute, how fantastic is this proposition?

If I asked you for £60 and could give you a reasonable assurance that within 18 months this particular £60 would clear £240 for you, wouldn't you be inclined to give me the £60? I think that you would.

But how can we fit an attractive proposition like this into the chicken business?

Well it is like this.

If I were a hatcheryman and the commercial chicks which I sold were capable of returning a profit of 3s. a bird more than the stock which another hatcheryman might be offering for £15 a 100 you, a chicken buyer, could afford to pay me as much as £30 a 100 for my sexed pullet chicks and still make as much profit as if you had bought my competitors' chickens for just half the price.

Now as the Americans would say "Isn't that something?"

But just what does an extra 3s. per bird profit represent?

Well if we confine the discussion to egg production it would mean that my fowls would have to lay an extra 10 or 11 eggs a bird more than the stock selling for £15 a 100. That is based on an egg price of 3s. 6d. per dozen, and it is assumed that the many other factors which influence profitability such as the ability of the stock to live, egg size, food consumption, etc., are constant.

Now let us assume that you are a commercial egg producer and interested in buying 2,000 day-old pullet chicks.

You come to my hatchery and I convince you that my stock is worth something less than £30 a 100 but not being greedy I agree to charge you only £18 a 100. As the figures given in this talk are not intended to be regarded as a standard I can of course afford not to be greedy. Now let us assume that this price of £18 is £3 a 100 more than that asked by my competitor whose stock lays 10 eggs a bird a year less than mine. So your 2,000 chickens are going to cost you an extra £60 but an extra profit of 3s. a bird on 2,000 amounts to £300 and if we deduct the extra price of the chickens namely £60 from this figure, you are left with an extra £240 in the bank.

Quite a fair investment to say the least and it is obvious that my chickens are worth more than £19 a 100 but just how much more depends on the ability of my stock to perform consistently well over several years in the Random Sample Laying Test conducted by the Department of Agriculture.

Let us not forget that the production of highly profitable poultry stock can only result from the outlay of much time and expense on a properly conducted poultry breeding programme. Such a programme entails a lot of extra work and expense which hatcherymen and breeders cannot afford under today's chick prices. Extra staff is required for managing the breeding stock, for trapnesting, for recording, and for analysing the results of the various matings and for all the other work associated with a properly run breeding programme. This staff has to be paid and the other expenses met.

We have seen, how you with your 2,000 chickens have been able to bank an extra £240 by buying quality stock, but how do I fare? Well if I was in the hatchery business in a reasonable way and sold 50,000 day old pullets annually and received an extra £3 a 100 for them (the difference between £18 and £15) I would clear an extra £1,500 annually which in my own interests I should plough back into poultry improvement work, with the object of maintaining steady improvement in my stock thereby ensuring your custom for years to come.

The Random Sample Laying Test does of course provide hatcherymen with an opportunity to prove to the buying public that the quality of their stock is good and continually improving and I am pleased to report that the number of entries for the second Random Sample Laying Test was equal to those of last year. The keen interest being shown in the Test which is a new type of test to Western Australia is indicative of the interest being taken by breeders and hatcherymen in this State to raise the quality of our poultry.

Departmental officers are already working in with many hatcherymen in an attempt to raise the egg-laying capacity of the State's poultry flock and are anxious to co-operate with other hatcherymen who may be contemplating launching out on a new breeding programme. So if you are interested please let us know.

FEEDING THE MILKING GOAT

By K. NEEDHAM, Dairy Cattle Husbandry Officer

TO most people who are not actively engaged in the care and management of milking goats a popular fallacy exists that these animals will produce milk on a very low plane of nutrition and that they are capable of surviving and producing almost exclusively by means of scavenging. How frequently when discussing goats, one hears the comment, made partly in joke, but very often in all sincerity, that these animals will consume paper bags, rubbish and clothing hung out on the line to dry.

It would be as well, right now, to make it perfectly clear that for a goat to thrive and to produce to capacity, it is equally important that it be as well fed as the dairy cow. It is true that goats will eat rubbish and paper bags, but for that matter so will any animal which is, in effect, starving.

Contrary to this popular belief, goats are actually very "fussy" feeders and prefer a wide variety of high-quality foodstuffs. To the breeder of high-quality animals it should be pointed out now that whilst these animals prefer variety, changes in foodstuffs should be made gradually, otherwise, digestive upsets will occur and production will be seriously affected.

All milk-producing animals must be fed to supply two main requirements. The first is known as "maintenance ration" which satisfies the energy requirements of the body to maintain the normal bodily needs of digestion movement, feeding, perspiration and respiration. Over and above this the second portion of the ration is required for the process of production, and this part of the ration must consist of high quality protein with normally a minimum of 16 per cent. crude protein.

Many dairy farmers, and the same can probably be said of goat breeders, tend to be wasteful when feeding the protein portion of the ration. Any source of protein is expensive and for its feeding to be economical it should be supplied according to the production of individual animals. Where they are under test or are hand-milked into a bucket it is a relatively simple matter, and as this is normally the procedure in goat herds there seems no practical reason why these animals should not be fed according to the pounds of milk they produce, individually, per day.

Once the maintenance ration has been supplied it is generally accepted that the goat which does not have access to pasture will require approximately 1 lb. per day of a 16 per cent. protein concentrate for every quart of milk produced. In other words, this is equivalent to 4 lb. per gallon.

In addition to providing concentrate in the bails, goats, like all ruminants, require a supply of roughage and this can be obtained either from hay, chaff, or, to some extent and depending upon the time of the year, from grazing in the paddocks. A supply of good quality roughage is equally essential as that of protein because every ration must be balanced in relation to protein and roughage.

In this State it would seem that more use could be made of high quality pasture for grazing goats, and by this means it will be possible to reduce the purchased concentrate bill.

Goats by nature prefer twigs and leaves to pasture and this aspect is always raised by the goat enthusiast. Nevertheless, it has been established beyond a doubt that if goats are given access to good quality, short-leaved, pasture, they will thrive and produce large quantities of good quality milk.

These animals are particularly fond of lucerne either as green-feed or hay and if supplies of it are available in either form it is possible to reduce the amount of concentrate in the form of grains or meatmeal which are fed in the bail at milking time. It should be remembered, however, that when they are being fed green lucerne they should have access to adequate quantities of roughage, otherwise, troubles can result.

Finally the diet of the milking goat will not be complete without access to mineral licks. A typical one consists of 2 parts bone meal to 1 part of coarse salt. This can be left available to the animals ad lib. to take it as they wish. Such a lick as this is particularly desirable when the animals are run under the intensive system, and have no access to paddock grazing.

Care in the feeding of goats and the use of some discretion in the preparation of their ration will repay amply the time spent in giving this attention.

FERTILISERS FOR VEGETABLES IN SUMMER MONTHS

By J. P. FALLON, Senior Adviser (Vegetables), Horticultural Division

EACH year at the Department of Agriculture, a number of requests for advice are received from both commercial growers and home gardeners regarding the failure of vegetable crops during the very hot weather. This applies particularly to such crops as tomatoes, beans, melons, pumpkins and sweet corn. In nearly all cases, when an investigation has been carried out, it is found that the trouble is due to an imbalance of fertiliser.

High production of good quality vegetables is closely linked with the use of correct fertilising methods. Since the necessary plant foods can be largely provided by proper methods of fertilising, the grower is able to exercise considerable measure of control over yield and quality.

Most fertiliser mixtures contain the three major plant foods, namely nitrogen, phosphate and potash. If plants are unable to obtain any one of these three, a depression of growth results and definite characteristic symptoms become apparent. It is therefore important to use a fertiliser mixture which will supply all of the major plant nutrients. However, it is also essential to ensure that the three are provided in balanced proportions.

Many growers, rather than purchase a ready-mixed fertiliser, prefer to use a fertiliser which they have made up themselves and which they believe to be best suited to the particular crop and conditions under which they are growing. Very often, these growers, if they give insufficient attention to the matter of fertiliser balance, find that, particularly during hot weather conditions, their crops exhibit symptoms of disorder.

Throughout the study of fertiliser and manurial practice and in fact, all plant relations, it is well to remember the principle of the limiting factor. It is a matter of common observation that no amount of fertiliser added to a soil will give a crop if too little moisture is present. Here moisture may be called the limiting factor.

Plant growth is dependent on many factors including light, temperature, moisture and nutrients. Performance in a given instance is not determined by the average of all factors or by the factor that is present in most favourable degree. Rather, it is governed by the factor that is present in least favourable degree in other words by the limiting factor.

During the summer months when vegetable crops grow so rapidly, many growers are apt to over-stimulate growth by the use of heavy dressings of nitrogenous fertilisers. This promotes an abundant top growth of succulent foliage but unfortunately the root system does not always develop in proportion. As a result, under heat wave conditions or during periods of hot drying winds, the plant finds it is incapable of maintaining a sufficient supply of moisture through the root system to meet the demand of the extensive foliage area. Such plants very often become stressed for moisture even though the soil may be quite moist. In the case of plants like tomatoes, beans or melons, this stress for moisture may result

in flower drop. In the case of tomatoes the fruit may develop a trouble known as Blossom End Rot. Similar effects occur with other crops.

The value of organic matter as a means of maintaining the moisture capacity of our metropolitan area sandy soils during summer months is well appreciated by most growers. However, the fact that organic matter also plays an important part in retaining fertiliser constituents against leaching is sometimes forgotten.

Under sprinkler irrigation, both nitrogen and potash fertilisers are very rapidly leached out unless the organic matter status of the soil is good. Nitrogen is replaced in the topdressing normally carried out but unfortunately, in many instances, the replacement of potash is overlooked.

Growers are advised to give particular attention to the matter of balanced fertiliser applications especially during periods of very hot weather. Care should be taken to apply only the smallest necessary amounts of nitrogenous manures which encourage succulent leaf formation and to ensure that adequate supplies of potash and phosphate fertiliser are available to the plants.

PASTURES AND THEIR CARRYING CAPACITY

By H. G. ELLIOTT, Assistant Superintendent of Dairying

THE term pasture is very widely used by dairy farmers in the South-West, and usually refers to any form of cleared land carrying vegetation ranging from poor annual weed species to the best of clover and grasses. Naturally, looking at the position from this point of view it is of little wonder that there is such a wide variation in carrying capacities from farm to farm. Again one is frequently informed by the owner that he is carrying a certain number of stock on so much land—disregarding the amount of fodder, concentrates or grain products which are purchased and fed to them—and thereby giving a false value to the pasture.

Now let us consider how the carrying capacity of a pasture can be altered. A pasture field may have vigorous growth with an excellent mixture of grass and clover capable of carrying a large beast to four acres the year round, but within a few years unless closely watched and carefully managed, it can lose vigor, alter botanically and only produce sufficient for one large beast to eight or more acres.

Why this change? This lowering of carrying capacity can be brought about by many causes such as poor management, insufficient fertiliser, deficiencies of major or minor elements, diseases and insect pests, and finally the use of poor strains and species of pasture plants in the sward. Any one or more of these can cause a decline in production.

Can we say that we have reached maximum production, or the highest carrying capacity of annual pastures, when we refer to a carrying capacity of a large beast to four acres?

It is obvious from experimentation and research that some of the best types of annual pastures, if managed efficiently have carried better than that. Yield figures have indicated that a dry matter yield of 5 tons or more per annum is not impossible. If that is the case a carrying capacity of one beast per acre for the year round should not be impossible, but it is not obtained, due principally to the bulk of the material being produced in five months, while the animal requires grazing over 12 months. Much loss of valuable nutrients occurs during the latter part of the plants' life and when the material is dry. Probably the largest loss of the most valuable protein material occurs with leaf drop and shattering from maturity onwards.

Every means possible should be made to utilise the production of high-class pasture material, by efficient grazing under a rotational system, by use of electric fences and by conserving as much as possible of the surplus spring production in the form of high-quality hay and silage. This surely will assist in lifting the carrying capacity of good pastures.

Again if all the good pasture species were freed from competition by vigorous-growing weeds such as capeweed and other early low-quality feed such as speargrass, silvergrass, hop clover, etc., much greater production could be expected. Similarly if pests such as the rabbit, red-legged earthmite, lucerne flea, cutworms, slugs, etc., were all controlled, and plant diseases kept down much higher overall yields and carrying capacities of the pastures could occur.

Apart from the points already mentioned, much greater carrying capacity could be expected from many pastures if they were efficiently drained, and where necessary supplied with whatever element or elements, both major and minor, may be deficient. On most farms, phosphate is applied, on many potash is needed, and many of the areas in the South-West require one or more minor elements, such as copper, zinc and molybdenum.

The effect of poor renovation, lack of a ley system or cropping, and uncontrolled grazing on pastures all tend to reduce their carrying capacity.

If some of these matters receive attention, greater carrying capacity could be obtained, resulting in far greater incomes to the owners of the pastures. It has been worked out that by raising the present estimated carrying capacity from one beast to 4½ acres to one to 3½ acres on present prices the farmers would have an increased gross return of £3 million in the higher rainfall pasture areas of 1½ million acres.

POLLINATION

By J. CRIPPS, Adviser, Horticultural Division

SOME knowledge of the mechanics of pollination should be of interest to orchardists since it directly affects their livelihood. The fusion of two cells which takes place at fertilisation and as a result of pollination gives rise to the fruit, which represents the profits.

Fruit trees are usually wind or insect pollinated. Wind-pollinated trees include walnuts and chestnuts and these produce large numbers of tiny inconspicuous flowers which produce vast quantities of pollen to compensate for the enormous waste which occurs in its transfer. Wind-pollinated trees are self-fertile, and pollination depends on weather conditions. The orchardists can therefore do little to ensure an adequate set of fruit or nuts.

This is not the case, however, with other types of fruit, the flowers of which are insect-pollinated; these are supplied with anthers (which shed pollen on to visiting insects) and stigmas equipped with a sticky surface to collect pollen adhering to insects. Most insect-pollinated flowers are arranged so that they cannot be fertilised with their own pollen. Usually pollen maturity does not synchronise with stigma receptivity in the same flower, and the anthers most commonly mature before the stigmas. Pollen may be received from other flowers on the same tree in which case the variety is self-fertile. If pollen has to be obtained from another variety self-sterility is indicated.

The honey bee is usually considered to be the most effective agent for the transfer of pollen from one flower to another, but various other insects do this work. Unfortunately, honey bees only work under good weather conditions and other insects are probably of more use in bad weather. Also, if efficient cross-pollination is to be effected, bees should be so numerous that competition for nectar forces them from one tree to another.

The mere transference of pollen from one flower to another does not necessarily mean that fertilisation has been achieved however.

After the pollen grain has alighted on the adhesive stigma, fertilisation is actually effected by a pollen tube which grows down the stigma into the ovary at its base and fertilises the ovum. But if the pollen is of low viability it may fail to germinate on the stigma. Low viability is

usually due to the condition of the tree from whence it came, and may be caused by poor health or an inadequate supply of nutrients during the differentiation of the flower buds.

Even if the pollen grain does germinate and commence to grow, the pollen tube may not reach and fertilise the ovum due to its slow rate of growth, or to the length of the stigma. Lastly, if the pollen which alights on the stigma fails to fertilise the ovum it may be because the variety is self-sterile, in which case pollen must come from the flowers of another variety.

The only variety of fruit which will set fruit without fertilisation is the Bartlett pear which does produce seedless or parthenocarpic fruit, but more fruit often results from cross-pollination.

Other varieties may be self-fertile, partially self-fertile or self-sterile and we must consider various fruits in slightly more detail.

Some apple varieties are partially self-fertile and under favourable weather conditions may set reasonably satisfactory crops with their own pollen. The Delicious variety is a possible exception. However, in seasons of adverse weather conditions, crops may be light and it is felt that the planting of large blocks of apples without a suitable pollinator involves a definite risk. Granny Smith, Delicious, Jonathan and Yates will all pollinate each other.

Pears, such as Bartlett and Packhams, normally set heavier crops when pollinated by another variety, but Packhams will not pollinate Comice, and Bartlett is better utilised.

All apricots and peaches except J. H. Hale are self-fertile and pollinators are unnecessary. Some Japanese plums are partially self-fertile but it is wise to provide for pollinators. Wickson appears to be self-sterile and is best pollinated by Satsuma or Santa Rosa. Narrabeen and Ruby Blood also need pollinators.

It is, of course, obvious that if a variety is known to need a pollinator, one must be selected with a flowering period which overlaps that of the variety to be pollinated. Further it should be well distributed through the planting. Two main systems are satisfactory. The first is the "one in nine" system, which, in fact, means that the pollinator occupies every third position in every third row so that 11 per cent. of the trees in any planting are pollinators. This system usually provides adequate pollination under local conditions.

Another method is for the pollinating variety to occupy every third row, so that one-third of the trees in any particular planting are of the pollinating variety. Apart from providing more adequate pollination, this system has certain economic advantages with regard to spraying and harvesting.

Before planting an area with fruit trees, the orchardist should therefore find out whether the varieties he has chosen require pollinators, and if so make provision for planting one or more suitable varieties in the most effective system both for ease of working and adequate pollination.

AEROPLANES AND INSECT PEST CONTROL

By P. N. FORTE, Senior Entomologist

THE use of aeroplanes in agriculture has received great impetus in Australia since World War II. This was due mainly to the availability, ex disposals, of large numbers of small aircraft which could be converted to apply sprays and dusts for agricultural purposes. In America, also for similar reasons, there are now about 5,000 aircraft engaged in aerial agriculture.

You might ask "What can the aeroplane do to help the farmer?" Well, it has proved an efficient machine for applying sprays and dusts to control insect pests of crops and pastures. Similarly it has proved its use in applying weedicides, to control weeds in crops and pastures and finally it has been used to apply super-

phosphate efficiently to areas of land which ground equipment could not treat.

Most people have heard of this being done in New Zealand but actually a large area is treated in this way in Australia and is increasing each year. For instance in 1957 well over one million acres of land in Australia had superphosphate applied by this method and 25,000 acres of this was in Western Australia.

During 1957, aircraft sprayed liquids such as weedicides and pesticides to over 200,000 acres in Western Australia—an acreage almost equal to that sprayed in all the other States put together.

Many farmers in Western Australia are aware of this method of applying insecticides and find it an effective solution to their problem of insect pest control. There are also many farmers who are not sufficiently acquainted with the industry of aerial agriculture to appreciate its usefulness to them.

The obvious advantage is that an aeroplane flying at 75 m.p.h. can cover many more acres per day than any ground equipment. Furthermore, as it passes through the air at low levels the aeroplane causes the spray to be broken up into fine droplets and forced down onto the ground. During wet winters the paddocks are frequently too boggy for ground equipment and can only be treated from the air.

I am sure that most farmers would appreciate these advantages this season with its plague of web worms and red-legged earth mite. The thousands of acres which have been treated this year in Western Australia could never have been treated by any other method.

Fundamentally the problem we have is applying a determined amount of a given insecticide evenly over a given area. Not so very long ago this was done by using 30 lb. of dust per acre or 100 gallons of spray. However with the aeroplane correctly equipped and flown we are able to reduce the volume applied per acre to as low as ½ gallon under good conditions.

The Department of Agriculture has conducted a large number of trials to test this method of applying insecticides and these were started in 1949. Since then it has establishd the success of the method and although most of this work has been done on grasshoppers the results are applicable to other insect pests of crops and pastures.

The following crops have been successfully treated by aircraft in Western Australia for insect pests: Potatoes, peas, linseed, flax, wheat, oats, barley and pasture.

The following insects have been successfully controlled in Western Australia with insecticides applied by aircraft: Red-legged earthmite, lucerne flea, webworm, climbing cutworm, pea weevil, grasshoppers and pasture caterpillars.

"KILL THOSE FLIES"

By H. MASLIN, Dairy Instructor, Busselton

FLIES are carriers of disease which can be transferred to milk and to human beings, so it is the duty of every dairy farmer to do all he can to prevent them from feeding and breeding on his property. Do not allow them to feed and breed on dirty milk drums, manure heaps, decaying matter or in filthy drains.

There are two main species of flies which are most commonly seen around dairy premises. One of them—*Musca domestica*—feeds on decaying vegetable matter, dung and all types of filth. The other species, *Stomoxys calcitrans* is the fly which bites and feeds on blood. It breeds in straw and decaying hay, rotting grass or grain.

Regulations under the model by-laws of the Health Act provide that the milk room shall be fly-proof and the farmer shall not allow dung to accumulate around the dairy premises.

The dairy instructor does not ask for manure heaps to be removed from the vicinity of the dairy premises just because they are unsightly, but because they are

breeding places for flies and a serious hazard to the purity of the milk. Pick up the dung from the cow-yard daily and remove the heaps from the vicinity of the cow-yard at short regular intervals. This helps to control flies breeding and thus assists control of flies in the dairy.

It takes approximately 10 to 14 days for the egg of a fly to develop into the adult insect, so elimination of breeding places such as manure heaps and drains covered with rotting grasses and hay is much more effective than killing the adult flies which are each capable of laying many eggs.

Cans of milk or cream that have to be held in the dairy should be covered with clean fly-proof covers, such as fly-wire or mosquito netting.

The best way to attack the adult fly is by sprays and baits. When selecting sprays, care should be taken to choose the most effective mixtures and to use them in accordance with the manufacturer's instructions.

The ordinary household fly spray, which usually contains such agents as pyrethrum or lethane, quickly kills any flies which come in contact with it, but once the air clears the killing effect ceases. Therefore in such open places as the milking shed it is not very efficient, but in the milk room which can be closed up it is more effective.

Residual sprays usually contain lindane, DDT or other insecticides which remain effective for weeks and are very suitable for spraying in the milking shed. The use of DDT sprays in the milk room is not recommended as milk and cream will absorb the odour.

For best results the insecticides should be sprayed freely on the walls, ceilings and any structures within the milking bails. Care should be taken to cover any feed boxes in the milking shed before spraying. Diazinon fly bait should be used around all window ledges and any other places within and around the dairy premises where it presents no danger to children, livestock and poultry.

Let us beat the fly by:—

(1) Removal of any favourable breeding grounds. Shift the manure regularly. Keep drains clean. Remove any decaying or rotten vegetation from around the dairy premises.

(2) Keep the dairy premises and utensils clean at all times. Wash the skim milk drums and pig-feeding tins regularly.

(3) Use a recommended fly spray and bait to attack adult flies.

(4) Rinse the milking machine before milking with a sodium hypochlorite solution (one dessertspoonful per gallon of water).

Safeguard your health and your cream by beating the fly.

GRAZING FOR PIGS

By P. BECK, Field Assistant, Dairying Division.

THE pig is the fastest-maturing of all farm livestock and the pig-raiser's main objective is to make money by the conversion of feedstuffs—per medium of the pig's digestive system—into edible meat that will conform to the requirements of the consumer.

Although the pig is able to adapt itself to poor conditions of management, its ability to make profitable liveweight gains is considerably reduced when it is subjected to such circumstances. It is necessary, therefore, in planning accommodation that the farmer should consider the health and comfort of his livestock and plan, so far as possible, to prevent disease by adopting suitable methods of housing, feeding, and management.

The foremost consideration in planning is sanitation, and this applies irrespective of whether the pigs are maintained by the grazing or open air system or the indoor or intensive system. Both types of pig-raising have the one common objective, in that bare dirt yards, muddy areas and

uncleaned pens must be avoided. Disease-causing organisms which can be extremely detrimental to the health of livestock are harboured under these conditions.

Where the property is large enough the paddock system has many definite advantages and even if the area is restricted, combined intensive and grazing methods are especially convenient for sows and litters.

In the heavier rainfall districts where first-class grazing land is available it is usual to allow approximately one acre per sow and progeny, but in the drier wheat-belt conditions the allowance should be increased to five or even ten acres.

Let us now take a closer look at the merits of the grazing system of management. Perhaps the main feature is that a number of paddocks of different size may be utilised in rotation and during the resting period cultivated, and if possible cropped. This makes use of the fertilising value of the manure and is instrumental in reducing worm infestation by destroying the eggs.

The value of good green actively-growing pastures and fodder crops shows itself in its ability to provide minerals and vitamins often lacking in the basic meal ration. Pastures such as mixtures of oats or barley and clover, Kikuyu grass, also field peas and kale are of great value. Lucerne, elephant grass and maize are usually hand-fed, while root crops like fodder beet, sugar beet and mangels may be harvested by the pig or alternatively pulled and hand-fed. Potatoes of course must be boiled before feeding.

It is estimated that 6 lb. of good pasture is equal in feeding value to 1 lb. of concentrate meal, and with the provision of good grazing, the intake of concentrates over a large number of pigs can be reduced with a subsequent reduction of feed costs. The amount of capital outlay on buildings is considerably reduced where grazing is practised—the intensive houses are unnecessary—as all growing pigs can be successfully brought to market weight on pastures and self-feeders.

In the selection of a site for the piggery the situation should be as central as possible, sheltered from the prevailing winds and with a north or north-easterly aspect to ensure adequate penetration of sunlight. Drainage away from the pens, proximity to water and shade are distinct advantages. All paddocks should be sized according to the class of pig they are to carry and linked by lanes which join the central area at the farrowing pens and feeding sheds. Shelter sheds must be installed in each paddock and should be portable as the area adjacent to fixed sheds soon becomes what may be termed as "pig sick."

Special attention to construction of farrowing sheds is of great importance as young pigs require every protection from overlaying by the sow and being chilled in the cold damp weather. Give your young pigs every advantage of good grazing and husbandry to achieve earlier market weights and faster, more profitable returns.

"FEED FLAVOURS IN CREAM"

By an officer of the Dairying Division.

CREAM for butter-making is purchased at the factory on the basis of its grade and test. The grade means the quality of the cream as to flavour, odour, and appearance. The factory grader is a qualified operator, who has had long experience in detecting the various odours and flavours which affect cream quality and he holds a certificate for this work issued by the Department of Agriculture, after having passed the examinations prescribed by the Dairy Industry Act.

Because butter factories are now equipped with up-to-date vacuum distillation units for cream treatment there is a tendency to think that feed and other inferior flavours are not important, but any undesirable flavour in your cream will lower the grade, resulting in a lower price. Furthermore, to effectively treat it, the

factory manager has to slow up the rate of processing and increase the pasteurising temperatures according to the proportion of this class of cream received. This increases the cost of manufacture, which cost is ultimately borne by all producers.

There are many avenues through which flavour and odour may be affected. Most of these are of bacterial origin due to contamination during production and can be controlled by improving the general hygiene in the milking shed and dairy premises.

Cream quality, however, can be greatly affected by the food which the cow eats. The particular flavour of each food is absorbed by the blood stream during the process of digestion and passes via the blood stream to the udder where during the production of milk it becomes associated with the butter-fat. Good mixed pasture imparts a desirable clean, nutty flavour to cream. In practically all West Australian pastures the dominant legume is subterranean clover and whilst this is an extremely valuable feed, its flavour in cream is pronounced. Many pastures have a large proportion of Capeweed in their make-up and many are infested with scrub and other weeds. The combination of these produce feed flavour in cream which is very noticeable and it increases during the season as the plants approach the flowering stage. It is rarely severe enough to warrant classing the cream as second-grade but at ordinary intensity, will prevent it being graded "choice." Feed flavour in very thin cream is often associated with gas production, known as "feedy ferment," and this cream is always second-grade.

Where cows are grazed on lush pastures of the type just mentioned, it is not possible to completely exclude feed flavour from the cream but here are some methods by which the condition can be greatly improved. Firstly the cows should be removed from the pasture at least two hours prior to milking, particularly the evening milking. The taint is thus given a chance to be worked out of the system, apparently through the lungs. Secondly, the separator should be set to skim at 40-42 per cent. fat. This gives a cream of good consistency and reduces the tendency to gas formation. Feed flavours are fairly volatile and can be improved by aeration; therefore if the cream coming from the separator is run over a surface cooler in a clean atmosphere the taint will be reduced considerably and the temperature lowered; further aeration can be gained by frequent stirring in the can using a metal plunger with a mushroom end.

These suggestions are not new; they have been common knowledge for many years but they should not be treated lightly. The quality of the raw cream is still the chief factor determining the quality of the finished butter, and the production of good butter from "feedy" cream is at best, doubtful and is costly to all sections of the industry.

THOSE OLD MILK AND CREAM CANS

By D. C. MICKLE, Dairy Instructor, Bunbury

THE trend of modern dairy equipment continues more and more towards the use of stainless steel. Have you ever considered the reason for this? I suggest that the reasons be in—

(a) The superior standard of cleanliness which can be achieved;
(b) economy in plant replacements;
(c) improved flavours in the finished product; and
(d) a pride in the appearance of equipment which promotes sales and service.

There can be no doubt in any producer's mind as to the suitability of stainless steel as a material with which to build milk and cream cans, particularly cream cans, for these vessels are daily in use as means of storing cream awaiting transport to the factory. Too often we find that cream which has developed a high degree of natural acidity has been stored for up to four and five days in a battered old can, the tinned surface of which has practically disappeared.

Many old cans seen at factories have large areas of rusty, exposed iron, and others have numerous pin-holes of tinless metal on the interior surfaces of the can. This condition causes the development of a metallic flavour in the cream or milk, particularly when acid production has commenced. This is a typical, astringent flavour which develops in the cream with the production of metallic salts. The acid in the cream enters into chemical combination with metals such as the exposed iron or steel of the can.

The really bad feature, too, is that pasteurisation of the cream or milk intensifies this chemical action, and as the metallic salts formed possess catalytic properties, their action continues, resulting in flavours of fishy, tallowy nature in the finished dairy product.

It will therefore be quite obvious to you that using only the best equipment can give satisfactory results. Certainly, stainless steel cans require a big financial outlay in the first instance, but remember, the initial cost is the last cost. Don't take too much pride in having used the same old can for the past 25 years—"and never been tinned yet"—if its tinning is not bright and it has even a trace of metal showing. Take a lesson from the stainless steel separator bowl and discs now in common use on farms. They will never wear out if treated with care.

If you cannot afford the outlay on the best then you are strongly advised to examine your milk and cream cans now and to discard the old battered cans which have really served you well. Those cans of sound construction which are dull and lacking in tinned surface and have bare metal exposed should be re-tinned immediately.

It is well to remember that a badly pitted surface in cans does not always re-tin satisfactorily. This is due to the tendency of the tin to stretch across some of the pits rather than to fill them and rust spots soon make their appearance where this tin breaks away.

By the appearance of many of the old rusty-looking cans used in transport of milk and cream to the factories, it seems possible that in between seasons such cans are used as water containers, or for other purposes, or are left outside in the weather until wanted again. They become wet and sometimes are left with water in them. This is the start of poor appearance followed by rust development. The careful producer stores his un-used cans in a clean, dry area and ensures their good condition by covering the internal and external surfaces with a thin coating of petroleum jelly. When daily milk production applies, the cans should be placed on a rack up-side-down to ensure that they can dry out. They should then be sterilised just before use. The attention given to some cans is quite obvious on the factory grading floor and their good condition merits the pleasure the cream grader finds in handling such cans.

Again I emphasise that a wet can is the start of a rusty can, unfit for use in production of dairy products.

"OVERUN" IN BUTTER MAKING AND QUALITY IN HOME-MADE BUTTER

By A. H. HOBBS, Dairy Produce Inspector

WE frequently hear farmers say that the weight they get paid for when they send cream to a butter factory is lower than if they made the same cream into butter on the farm. This is explained by the fact that the Regulations under the Dairy Industry Act require that cream for butter making supplied to a factory shall be bought from the farmer on the basis of its fat content.

Each supplier's cream arriving at the factory is weighed and sampled and the percentage of fat in it is determined by a chemical process known as the Babcock Test. Then by multiplying the weight of cream in lb. by the percentage fat test, the lb. of fat are calculated and paid for at so much per lb. fat.

Suppose a farmer sends in 10 lb. of cream testing 40 per cent. of fat; this means that the cream contains 4 lb. of pure fat. If Mrs. Farmer had made this cream into butter, the butter would contain 4 lb. of fat, plus water and salt, and also some curd from the butter milk. The name given to this water, salt and curd is "overrun," and it usually amounts to about 22 per cent. of the weight of the fat; so that the 4 lb. of fat in the cream would be increased by 22 per cent. to make nearly 5 lb. of butter.

Now the amount of water, salt and curd in butter varies, therefore the amount of butter made from a certain quantity of cream will vary from day to day. But the amount of fat in cream at a certain test is constant, and that is why it is compulsory for factories to buy on this basis. Butter normally contains 15 to 16 per cent. of water, 1½ to 2 per cent. of salt and about 1 per cent. of curd. As the farmer has no means of testing the butter, it will be found that the water, salt and curd are often greater than these amounts, with the result that the overrun on farm butter may be 25 per cent. or higher.

However, I would not deter farmers from making butter for their own use. If you are a long way from town it may be convenient and profitable. Fresh, well-made farm butter can be very palatable. It should however, be made in small batches because it is normally made from cream in which the acid has developed to the stage where the cream is slightly sour; and while this gives the butter a desirable flavour when fresh, it is the main reason why farm butter will not keep. On the other hand, factory-made butter in Australia may have to stand up to storage periods of seven to eight months and sometimes longer. Therefore, the acid in sour cream delivered to the factory is carefully neutralised back to the sweetness of table cream. This butter has a milder flavour, but it will remain in good condition for long periods in low temperature storage.

Do not forget, also, that to make good butter on the farm the temperature of the cream needs to be kept at about 50° F. for several hours, and after churning, the butter grains need washing with clean water at the same temperature. This gives a firm fat which allows sufficient working, to give even distribution of the water and salt, and develop a plastic spreadability without becoming greasy.

Cleanliness, of course, is of prime importance. All utensils after use should be scrubbed with hot water containing washing soda, then finally rinsed in plenty of boiling water and left to dry without wiping. They should be scalded again and then dipped in cold water for a few minutes before making the next batch.

MILK FLOW INDICATORS

By G. W. SCOTT, Dairy Instructor, Head Office

DURING recent years, considerable attention has been given to efficient machine milking, both in the research field, and in passing worthwhile information to dairy farmers. While many farmers have applied the recommendations with excellent results there are still those who are reluctant to change the methods to which they have become accustomed over years. However, it is recognised by most dairy farmers that fast milking has considerable advantages, such as saving time in the shed, allowing more grazing time for the herd, and other things being equal giving increased production.

There are many factors which contribute to fast, clean milking, including the type of milk flow indicator incorporated in the machine, and today it is proposed to elaborate on this subject.

Most early model milking machines were not equipped with indicators and the only method of determining when cows were milked out was to feel the milk pipes by hand, and judge the position by the warmth of the pipes.

Many of these machines are still in use and it is admitted that some operatives are surprisingly accurate in gauging the end point of milking. However, the element of guesswork must always be

present under these conditions, and there is a tendency to leave the cups on longer than necessary, particularly when machine stripping.

In this modern age it is recommended that cows should be stripped by the machine instead of by hand and it is considered that the majority of farmers now use the machine method, for stripping, which calls for the use of reliable milk flow indicators.

Several types of indicators are installed on milking machines as standard equipment or they are available for fitting to most makes of machines. The early type of indicators consisted of a short length of glass tube placed in the rubber milk line from the teat cup claw, and although these are inefficient they are still used on some farms and in general when herd-testing buckets are used. The most common type consists of an inverted glass jar fixed at the junction of the milk dropper tube and the main milk line, or a glass cylinder clamped between two end plates.

These types are considered to be quite useful but do not give a definite end point indication when the cow is milked out, and once again there is the tendency to leave the cups on the teats longer than necessary. This is due to the fact that a very small quantity of milk passing through the indicator appears to be of much greater significance than it really is. In effect, a few drops of milk will spread and cover the inside surface of the glass which is misleading to the operator.

In order to overcome this, research workers in New Zealand designed the Ruakura milk flow indicator which is simple, easily cleaned and readily available for fitting to all makes of machines.

Basically it consists of a bakelite body with a circular glass window approximately two inches in diameter. While the milk is flowing freely the space behind the window is completely filled with milk, but as the milk flow decreases the level behind the glass falls accordingly and can be observed as a well defined line without the splashing and surging which is evident in other types. When the milk level in the indicator falls close to the bottom of the glass it is the signal for machine stripping to be commenced. This is done by pressing down on the teat cup claw and giving the udder a small amount of massage. When this stripping is started the level on the indicator glass will rise slightly if the cow is still giving milk. As soon as the milk disappears from behind the glass the rate of milk flow has dropped to half a pound per minute and milking is completed.

Before concluding, it is felt that a few hints on the installation of the Ruakura Regulator may be worthwhile.

Firstly, it is essential that it is mounted with the two fixing screws truly horizontal. Secondly, it is desirable that it should be mounted with a slight slope out at the bottom to assist in keeping the flap closed, and thirdly, it is an advantage to have the milk dropper tap at the bottom of the dropper tube instead of at the top.

LAMB PRODUCTION AT ESPERANCE

Recent recommendations by the Esperance Development Advisory Committee were that the area should be developed primarily on a pasture-stock basis for the production of wool and meat.

This has been the policy of the Esperance Plains Research Station since its inception. Registered and commercial flocks of Corriedale sheep, together with some Merinos, have been maintained on the research station for several years and a breeding unit of Aberdeen Angus cattle was established there early last year.

The scope of investigation into stock husbandry is being further widened to include quality fat lamb production during the coming season. Two Southdown and two Suffolk rams were acquired recently and these will be mated to Corriedale ewes which are known to be good mothers for fat lamb production.

Good quality fat lambs have already been produced in this area, but more precise knowledge will be obtained by comparing the carcass quality of lambs obtained by different breeds of sires.

METTERS

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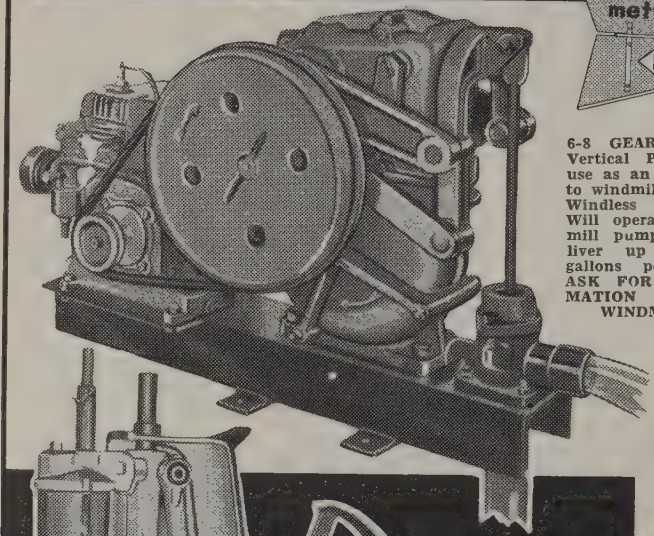
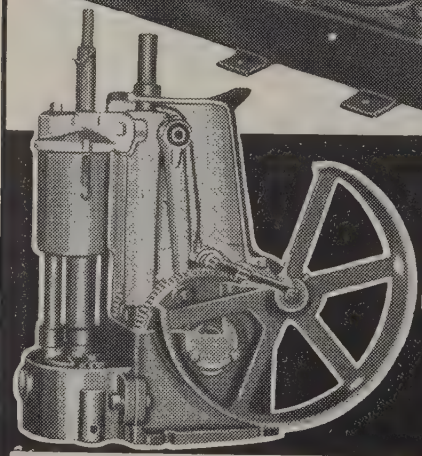
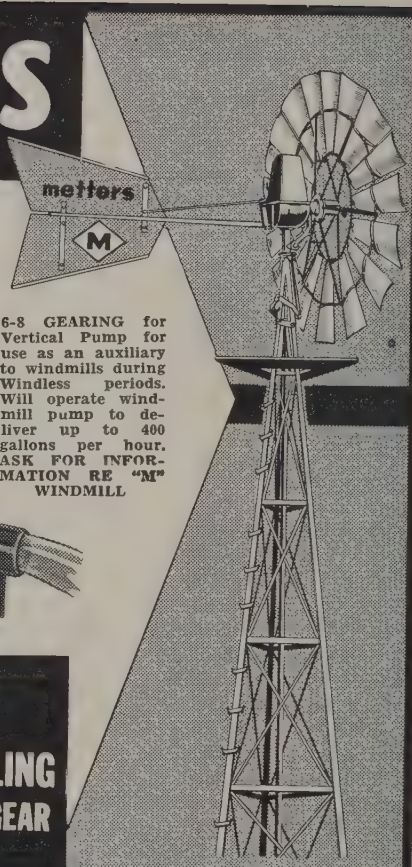




SELF - OILING PUMPING GEAR



6-8 GEARING for Vertical Pump for use as an auxiliary to windmills during Windless periods. Will operate windmill pump to deliver up to 400 gallons per hour. **ASK FOR INFORMATION RE "M" WINDMILL**

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City water pressure at the turn of a tap, or for emergency use on windmill installations in windless periods

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Fast, reliable. Fills from ground level, underground tanks, etc. Also for other pumping and water transfer tasks

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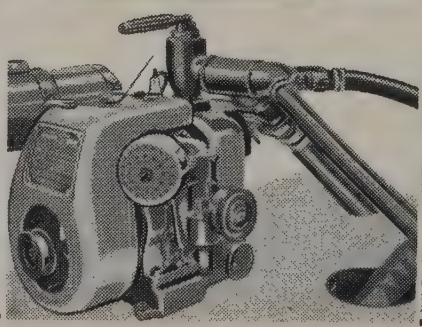


List of Registered Fertilisers, 1958-59

By H. G. CARISS, Inspector of Fertilisers

THE Fertiliser Act, 1928-1955, requires all fertilisers sold in this State to be registered annually, the registration year commencing on November 1 each year. A list of fertilisers registered for the current registration year appears in this issue. Departmental inspectors carry out regular inspection and sampling of fertilisers to see that those offered for sale comply with the requirements of the Fertiliser Act, including the registered analysis. The knowledge that this work is being carried out, induces manufacturers to maintain their fertilisers close to and usually a little above the registered standard.

From the fertilisers registered, unit values, i.e., the average commercial value of each one per cent., of a given ingredient per ton of fertiliser, have been calculated for the various forms of the main fertilising ingredients, nitrogen, phosphoric anhydride and potash. These values are arrived at from the average of prices quoted for each fertiliser at the time of registration and are as follows:—

	s.	d.
Nitrogen (N) as—		
Blood, Blood and Bone, Bone Dust and other animal fertilisers	83	2
Nitrate	51	3
Ammonia	37	10
Urea	35	7
Phosphoric Anhydride (P_2O_5) as—		
Water soluble in superphosphate	11	9
Citrate soluble in superphosphate	11	9
Acid soluble in superphosphate and rock phosphate	6	5
Blood and Bone, Bone Dust and other animal fertilisers	27	11
Potash (K_2O) as—		
Sulphate	17	6
Muriate (Chloride)	11	11

From unit values a comparison of the commercial value of fertilisers of similar types can be made. As will be appreciated, however, it is not possible to compare, say for example the value of nitrogen in blood and bone with that in sulphate of ammonia.

It should be remembered that unit values are average values arrived at from the prices of all fertilisers registered. The commercial values arrived at from the use of these figures will therefore in some cases be more and in others less than the actual selling price. Other points to be borne in mind are fluctuations which may occur during the year in market values and in the case of mixed fertilisers, e.g., potato manures, the cost of mixing and extra handling which must be added to figures arrived at from the use of unit values.

To calculate the value of a fertiliser from unit values the percentage of each ingredient in the fertiliser should be multiplied by its unit value and the results for each ingredient in the fertiliser totalled. An example of how this can be done and how a comparison of values can be made between fertilisers of similar types is as follows:—

	Nitrogen.	Phosphoric Anhydride.
	%	%
X Brand Blood and Bone	6.5	10.0
Y Brand Blood and Bone	5.5	13.0

The unit values of nitrogen and phosphoric anhydride in blood and bone as set out above are 83s. 2d. and 27s. 11d.

respectively. The comparative commercial value of X and Y Brand blood and bones would therefore be:—

X Brand Blood and Bone.

	s.	d.
6.5 units of Nitrogen @ 83s. 2d. per unit	540	7
10.0 units of Phosphoric Anhydride @ 27s. 11d. per unit	279	2
Total Value	819	9

Y Brand Blood and Bone.

5.5 units of Nitrogen @ 83s. 2d. per unit	457	5
13.0 units of Phosphoric Anhydride @ 27s. 11d. per unit	362	11
Total Value	820	4

The fertilising ingredients contained in X Brand are worth more than those in Y Brand and therefore if the two fertilisers were offered for sale at the same price the X Brand would be the more economical to purchase.

Buyers of fertilisers are advised to consult the list of registered fertilisers and to ensure that packages containing fertilisers are correctly branded and/or labelled, i.e., carry a copy of the registered brand and name, and in the case of fertilisers contained in packages of 1 cwt. and under, a label setting out the registered analysis, before purchasing same.

If any doubts about a fertiliser arise inquiries should be made at the Department of Agriculture where information on the provisions and requirements of the Fertiliser Act and advice on matters concerning the use of fertilisers can be obtained.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928-1955, for the year commencing 1st November, 1958.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928-1955, for the year commencing 1st November, 1958

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Soluble	Citrate Soluble	Acid Soluble	Total Soluble	Sulphate	Muriate	
A. MINERAL				%	%	%	%	%	%	%	%	%	%	
1. Nitrogenous														
(a) *Nitrogen as Nitrate*														
Chilean Nitrate of Soda	25	Champion	Chilean Nitrate Sales Corporation Pty. Ltd.	16·00	....	....	....	....	....	....	....	....	....	£35/0/0 (PW)
Nitrate of Soda	119	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	16·00	....	....	....	....	....	....	....	....	....	£41/0/0 (PW) £42/5/0 (PJW)
Do. do.	173	Symonds ...	E. Symonds	16·00	....	....	....	....	....	....	....	....	....	Packets
Do. do.	183	David Gray's	David Gray & Co. Ltd.	16·00	....	....	....	....	....	....	....	....	....	Packets
Do. do.	200	Wesfarmers	Westralian Farmers Co-op. Ltd.	16·00	....	....	....	....	....	....	....	....	....	Packets
Sodium Nitrate	251	Faulding ...	F. H. Faulding & Co. Ltd.	16·00	.. .	....	....	....	....	.. .	....	..		£8/8/0 (cwt.) (PW)
Ammonium Nitrate	252	do.	do. do. do.	30·00	....	....	....	....	....	....	....	....	....	£6/1/4 (cwt.) (PW)
Nitrate of Soda	260	Boans ..	Boans Ltd.	16·00	...	.. .	...	..	..	.. .	....	..	..	Packets

(b) *Nitrogen as Ammonia*														
Sulphate of Ammonia	6	Blue Cross	Agricultural Products Co.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	37	Wunda	Higgins Hardware	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	47	Evergreen Fertilisers	Voldemars Ertners	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	54	Freecorns	Freecorns	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	122	I.C.I.A.N.Z.	Cuming Smith Mount Lyell F.F. Ltd.	....	20·50	....	....	....	....	....	....	....	....	£38/15/0 (PW) £41/10/0 (GW) £39/5/0 (PJW) £38/15/0 (AW)
Do. do.	161	Best	W. J. Pascoe & Son	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	170	Symonds	E. Symonds	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	182	David Gray's	David Gray & Co. Ltd.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	199	Wesfarmers	Westralian Farmers Co.-op. Ltd.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	253	Faulding	F. H. Faulding & Co. Ltd.	....	20·00	....	....	....	....	....	....	....	....	£2/15/0 (cwt.) (PW)
Do. do.	258	Boans	Boans Ltd.	....	20·50	....	....	....	....	....	....	....	....	Packets
Do. do.	271	Manning Fertilisers	H. E. Powell	....	20·50	....	....	....	....	....	....	....	....	Packets
(c) *Nitrogen as Urea*														
Urea—N46	7	Blue Cross	Agricultural Products Co.	....	....	....	46·00	....	....	....	....	....	....	Packets
Urea Pink	29	Pesticides	Wilcox Moffiln Ltd.	....	....	....	45·00	....	....	....	....	....	....	Packets
Urea	181	David Gray's	David Gray & Co. Ltd.	....	....	....	46·00	....	....	....	....	....	....	Packets
Urea 45%	230	B.A.S.F.	Henry H. York & Co. Pty. Ltd.	....	....	....	45·00	....	....	....	....	....	....	£84/7/6 (P)
Urea 46%	231	do.	do. do. do.	....	....	....	46·00	....	....	....	....	....	....	£84/7/6 (P)
Urea 46%	239	Lanes	Lanes (W.A.) Pty. Ltd.	....	....	....	46·00	Bluret 0·3% to 0·5%			....	....	....	£84/0/0 (PW)
Urea	272	I.C.I.A.N.Z.	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	46·00	Bluret Maximum 0·3%			....	....	....	£75/0/0 (PW)
2. Phosphatic														
(a) *Rock Phosphate*														
Ground Phosphate Rock	75	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	....	....	36·60	36·60	....	....	£11/15/6 (PW)
Do. do.	79	A in diamond	Albany Superphosphate Co. Pty. Ltd.	....	....	....	....	....	....	36·60	36·60	....	....	£11/15/6 (AW)
Do. do.	97	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	....	....	36·60	36·60	....	....	£11/15/6(PJW)(GW)
Do. do.	124	Mount Lyell	do. do. do.	....	....	....	....	....	....	36·60	36·60	....	....	£11/15/6 (P)
Do. do.	137	Sickle	do. do. do.	....	....	....	....	....	....	36·60	36·60	....	....	£11/15/6 (P)
(b) *Superphosphate*														
Superphosphate	5	Blue Cross	Agricultural Products Co.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	36	Wunda	Higgins Hardware	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	52	Freecorns	Freecorns	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Superphosphate 23%	58	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£12/14/0 (PW)
Do.	78	A in diamond	Albany Superphosphate Co. Pty. Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£12/14/0 (AW)
Do.	96	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£12/14/0(PJW)(GW)
Do.	123	Mt. Lyell	do. do. do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	£12/14/0 (PW)
Do.	136	Sickle	do. do. do.	....	....	....	....	17·00	3·00	3·0	23·00	....	....	£12/14/0 (PW)
Superphosphate	160	Best	W. J. Pascoe & Son	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	167	Symonds	E. Symonds	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	186	David Gray's	David Gray & Co. Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	198	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	Packets
Do.	257	Boans	Boans Ltd.	....	....	....	....	17·00	2·00	4·00	23·00	....	....	Packets
(c) *Rock Phosphate and Superphosphate*														
50/50 Mixture	76	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£12/17/0 (PW)
Do.	80	A in diamond	Albany Superphosphate Co. Pty. Ltd.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£12/17/0 (AW)

(PW) Perth Works. (GW) Geraldton Works. (AW) Albany Works. (PJW) Picton Junction Works.

FERTILISERS—continued

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Soluble	Citrate Soluble	Acid Soluble	Total Soluble	Sulphate	Muriate	
2. Phosphatic—*continued*				%	%	%	%	%	%	%	%	%	%	
(c) *Rock Phosphate and Superphosphate—continued*														
50/50 Mixture	98	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£12/17/0 (PJW)
Do.	125	Mount Lyell	do. do. do.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£12/17/0 (PW)
Do.	138	Sickle	do. do. do.	....	....	....	....	8·50	1·50	20·00	30·00	....	....	£12/17/0 (PW)
3. Potassic														
(a) *Potash Muriate*														
Muriate of Potash	8	Blue Cross	Agricultural Products Co.	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	38	Wunda	Higgins Hardware	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	48	Evergreen Fertilisers	Voldemars Ertners	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	53	Freecorns	Freecorns	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	121	Sun	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	....	....	....	....	....	58·00	£34/10/0 (PW) £35/0/0 (jute bags) (PJW) £35/0/0 (AW)
Do. do.	162	Best	W. J. Pascoe & Sons	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	171	Symonds	E. Symonds	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	184	David Gray's	David Gray & Co. Ltd.	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	201	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	....	....	....	....	....	....	....	58·00	Packets
Do. do.	259	Boans	Boans Ltd.	....	....	....	....	....	....	....	....	....	58·00	Packets
(b) *Potash as Sulphate*														
Sulphate of Potash	39	Wunda	Higgins Hardware	....	....	....	....	....	....	....	....	48·00	....	Packets
Do. do.	120	Sun	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	....	....	....	....	48·00	....	£42/0/0 (PW) £44/10/0 (GW) £43/0/0 (PJW) £44/10/0 (AW)
Do. do.	172	Symonds	E. Symonds	....	....	....	....	....	....	....	....	48·00	....	Packets
Do. do.	185	David Gray's	David Gray & Co. Ltd.	....	....	....	....	....	....	....	....	48·00	....	Packets
Do. do.	202	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	....	....	....	....	....	....	48·00	....	Packets
4. Nitrogen as Phosphoric Anhydride														
Potato Manure "C"	72	Cresco	Cresco Fertilisers (W.A.) Ltd.		3·50			14·00	2·50	2·25	18·75			£19/9/6 (PW)
Do. do.	92	A in diamond	Albany Superphosphate Co. Pty. Ltd.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£19/9/6 (AW) £19/11/6 (PJW)
Do. do.	111	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£19/19/6 (GW)
Do. do.	132	Mt. Lyell	do. do. do.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£19/9/6 (PW)
Do. do.	150	Sickle	do. do. do.	....	3·50	....	....	14·00	2·50	2·25	18·75	....	....	£19/9/6 (PW)
Animal Organis and Mineral Fertiliser	189	Wooltana	Wooltana Industry Pty. Ltd.	....	....	4·00	....	....	2·00	7·15	9·15	....	....	£29/0/0 (P)
Lawn Manure	209	Dawn	Dawn Fertilisers	....	5·75	....	....	8·75	2·00	1·75	12·50	....	....	Packets
Garden Fertiliser	228	Sound	Cockburn Sound Fertilisers	....	....	4·00	....	3·00	1·00	2·00	6·00	....	....	£25/0/0 (W)
5. Nitrogen Phosphoric Anhydride and Potash														
Potato Manure "A"	9	Blue Cross	Agricultural Products Co.	....	2·50	....	....	13·25	2·25	2·50	18·00	....	5·00	Packets
Potato Manure "E"	10	do.	do. do. do.	....	3·50	....	....	11·50	1·25	2·75	15·50	....	8·00	Packets
Special Garden Fertiliser	14	do.	do. do. do.	....	4·00	....	....	3·00	3·00	6·00	12·00	2·50	....	Packets
BulbO	15	do.	do. do. do.	....	....	2·25	....	3·00	3·50	3·50	10·00	....	4·50	Packets
Hygro	24	Hymos	D. W. Moss	3·00	....	....	....	0·75	0·15	0·15	1·05	....	6·00	Packets
Rose Grower	31	Wunda	Higgins Hardware	....	3·80	....	....	6·30	1·80	3·70	11·80	....	7·10	Packets
Citrus Grower	32	do.	do. do.	....	5·20	....	....	5·10	2·00	4·00	11·10	....	4·60	Packets

Garden Grower	33	do.	do. do.		5·20			5·10	2·00	4·00	11·10		4·60	Packets
Potato Manure "E"	35	do.	do. do.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Lawn Manure	43	Evergreen Fertilisers	Voldemars Ertners		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Garden Manure	45	do.	do. do.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Potato Manure "E"	46	do.	do. do.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Do. do.	51	Freecorns	Freecorns		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Potato Manure "A"	70	Cresco	Cresco Fertilisers (W.A.) Ltd.		2·50			13·25	2·25	2·50	18·00		5·00	£20/1/6 (PW)
Potato Manure "B"	71	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Potato Manure "E"	73	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/12/0 (PW)
Orchard Manure	74	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Potato Manure "A"	90	A in diamond	Albany Superphosphate Co. Pty. Ltd.		2·50			13·25	2·25	2·50	18·00		5·00	£20/3/0 (AW)
Potato Manure "B"	91	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/10/0 (AW)
Potato Manure "E"	93	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/14/0 (AW)
Orchard Manure	94	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/10/0 (AW)
Garden Fertiliser	95	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/14/0 (AW)
Potato Manure "A"	108	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.		2·50			13·25	2·25	2·50	18·00		5·00	£20/4/0 (PJW)
Potato Manure "A2"	109	do.	do. do. do.		2·50			13·25	2·25	2·50	18·00	5·00		£21/18/6 (PJW)
Potato Manure "B"	110	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/11/0 (PJW)
Potato Manure "E"	112	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/15/0 (PJW)
Potato Manure "E2"	113	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50	8·00		£25/7/6 (PJW)
Orchard Manure	114	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/11/0 (PJW)
Garden Fertiliser	115	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/15/0 (PJW)
Tobacco Fertiliser	116	do.	do. do. do.		3·00			8·25	1·50	1·50	11·25	15·00		£29/5/0 (PJW)
Tomato Manure	118	do.	do. do. do.		3·50			10·25	1·50	2·00	13·75	10·00		£26/17/0 (PJW)
Potato Manure "A"	130	Mount Lyell	do. do. do.		2·50			13·25	2·25	2·50	18·00		5·00	£20/1/6 (PW)
Potato Manure "B"	131	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Potato Manure "E"	133	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/12/0 (PW)
Orchard Manure	134	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Garden Fertiliser	135	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/12/0 (PW)
Potato Manure "A"	148	Sickle	do. do. do.		2·50			13·25	2·25	2·50	18·00		5·00	£20/1/6 (PW)
Potato Manure "B"	149	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Potato Manure "E"	151	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/12/0 (PW)
Orchard Manure	152	do.	do. do. do.		3·50			12·50	2·00	2·25	16·75		5·00	£21/8/6 (PW)
Garden Fertiliser	153	do.	do. do. do.		3·50			11·50	2·00	2·00	15·50		8·00	£22/12/0 (PW)
Rose Manure	157	Best	W. J. Pascoe & Son			3·00		5·00	2·00	6·00	13·00		9·00	Packets
Potato Manure "A"	158	do.	do. do.		2·50			13·25	2·25	2·50	18·00		5·00	Packets
Potato Manure "E"	159	do.	do. do.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Lawn Fertiliser	165	Symonds	E. Symonds		4·25			4·00	3·50	4·50	12·00		3·75	Packets
Rose Fertiliser	166	do.	do.		4·25			4·00	3·50	4·50	12·00		3·75	Packets
Potato Manure "B"	168	do.	do.		3·50			12·50	2·00	2·25	16·75		5·00	Packets
Potato Manure "E"	169	do.	do.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Do. do.	180	David Gray's	David Gray & Co. Ltd.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Do. do.	203	Wesfarmers	Westralian Farmers Co-op. Ltd.		3·50			11·50	2·00	2·00	15·50		8·00	Packets
Rose Manure	210	Dawn	Dawn Fertilisers		(5·25)			7·75	1·25	2·00	11·00		3·25	Packets
Plant Food	211	do.	do. do.		(5·39)			7·85	1·15	2·00	11·00		3·50	Packets
Bulb and Corm Manure	212	do.	do. do.		1·90			9·20	1·40	0·80	11·40		9·00	Packets
Seedling Manure	213	do.	do. do.		5·30			8·75	1·25	1·00	11·00		4·40	Packets
Superhumas No. 1	214	do.	do. do.		2·00			1·80	0·50	0·20	2·50		2·00	Packets
Superhumas No. 2	215	do.	do. do.		4·00			3·00	0·50	6·50	10·00		0·50	Packets
Lawn Fertiliser	222	Apex	E. J. Fry Pty. Ltd.		(5·00)			3·00	1·50	4·50	9·00		2·00	£38/10/0 (PW)
No. 1 Fertiliser	224	do.	do. do.		(5·00)			3·00	1·50	4·50	9·00		2·00	£38/10/0 (PW)
Nitrophoska Grey	233	B.A.S.F.	Henry H. York & Co. Pty. Ltd.	5·30	6·20			3·00	5·50		8·50		17·00	£59/10/0 (P)
Nitrophoska Green	234	do.	do. do.	6·60	8·40			6·60	8·40		15·00		15·00 (as Nitrate)	£59/10/0 (P)
Nitrophoska Blue	235	do.	do. do.	5·30	6·70			5·00	7·00		12·00	10·10	8·90 (as Nitrate)	£59/10/0 (P)
Nitrophoska Yellow	236	do.	do. do.	6·60	8·40			6·60	8·40		15·00	0·90	11·10 (as Nitrate)	£59/10/0 (P)

(PW) Perth Works. (GW) Geraldton Works. (AW) Albany Works. (PJW) Picton Junction Works.

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Soluble	Citrate Soluble	Acid Soluble	Total Soluble	Sulphate	Muriate	
5. Nitrogen, Phosphoric Anhydride and Potash				%	%	%	%	%	%	%	%	%	%	
—continued														
Nitrophoska Red	237	B.A.S.F.	Henry H. York & Co. Pty. Ltd.	5·70	7·30	....	....	5·40	7·60	....	13·00	1·90	18·10	
Bumpercrop	240	Lanes	Lanes (W.A.) Pty. Ltd.	6·50	6·50	....	....	5·20	7·80	....	13·00	....	20·00	£59/10/0 (P)
Potato Manure "E"	256	Boans	Boans Ltd.	....	3·50	....	....	11·50	1·25	2·75	15·50	....	8·00	Packets
Orchard Manure	263	P.P.	Picton Produce Pty. Ltd.	....	(2·75)	....	....	7·50	....	14·00	21·50	2·00	....	£26/0/0 (PJW)
Garden Fertiliser	264	do.	do. do. do.	....	(2·75)	....	....	7·50	....	14·00	21·50	2·00	....	£26/0/0 (PJW)
Top Dressing Fertiliser	265	do.	do. do. do.	....	(2·75)	....	....	7·50	....	14·00	21·50	2·00	....	£26/0/0 (PJW)
Potato Manure	266	do.	do. do. do.	....	(2·75)	....	....	7·50	....	14·00	21·50	2·00	....	£26/0/0 (PJW)
Potato Manure "E"	270	Manning Fertilisers	H. E. Powell	....	3·50	....	....	11·50	2·00	2·00	15·50	....	8·00	Packets
Gard-N-Tabs	273	Geo. C. Warner	G. C. Warner Lab. Pty. Ltd.	....	14·00	....	....	19·00	....	....	19·00	....	24·00	Packets
Foli 8	274	do.	do. do. do.	....	20·00	....	....	20·00	....	....	20·00	....	20·00	Packets
6. Phosphoric Anhydride and Potash														
Super and Potash No. 1	68	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£17/1/6 (PW)
Super and Potash ...	89	A in diamond	Albany Superphosphate Co. Pty. Ltd.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£17/4/0 (AW)
Do. do.	107	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£17/3/0 (PJW)
Do. do.	129	Mount Lyell	do. do. do.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£17/1/6 (PW)
Do. do.	147	Sickle	do. do. do.	....	....	....	....	14·00	2·50	2·50	19·00	....	9·00	£17/1/6 (PW)

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride P_2O_5 as				Potash (K_2O) as		Minor Elements								Cash price per ton at Works (W) or on Rails, Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Sol.	Citrate Sol.	Acid Sol.	Total Sol.	Sulphate	Muriate	(Cu)	(Zn)	(Co)	(Mn)	(Mg)	(Fe)	(Mo)	(B)	(Al)	
7. Phosphoric Anhydride and Minor Elements				%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
Super and Copper Ore	59	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	....	....	....	13·00	2·25	3·75	19·00	....	....	1·25	....	....	....	....	....		....	....	£15/9/0 (PW)
Super and Copper Sulphate	60	do.	do. do.	....	....	....	....	16·00	2·75	2·75	21·50	....	....	1·25	....	....	....	....	....	....	....	....	£20/2/1 (PW)
Super, Copper, Zinc	61	do.	do. do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	....	....	....	£17/9/6 (PW)
Super, Copper, Zinc and Cobalt	62	do.	do. do.	....	.. ..	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	Trace	....	....	....	....	....	....	£19/15/0 (PW)
Super, Copper, Zinc and Molybdenum	63	do.	do. do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	Trace	....	....	....	Trace	....	....	£18/15/0 (PW)
Super and Zinc Oxide	64	do.	do. do.	....	....	....	....	16·50	2·75	3·25	22·50	....	....	....	1·15	....	....	....	....	....	....	....	£14/7/0 (PW)
Super and Manganese	65	do.	do. do.	....	....	..	....	14·50	2·50	2·50	19·50	....	....	.. ..	....	....	3·80	....	....	....	....	....	£24/6/6 (PW)
Super and Molybdenum	66	do.	do. do.	....	.. ..	.. ..	....	17·00	3·00	3·00	23·00	....	....	....	....	....	....	....	....	Trace	....	....	
Super and Cobalt	67	do.	do. do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	....	....	Trace	....	....	....	....	....	....	£15/12/0 (PW)

Super and Minor Elements	69	do.	do.	do.	....	....	....	....	11·75	2·50	2·25	16·50	....	....	1·00	2·25	....	2·25	....	....	....	....	....	£23/13/8 (PW)
Super, Copper Ore	81	A in diamond	Albany Superphosphate Co. Pty. Ltd.		....	....	....	....	13·00	2·25	3·75	19·00	....	....	1·25	....	....	....	....	....	....	....	....	£16/9/6 (AW)
Super, Copper Ore and Zinc	82	do.	do.	do.	....	..	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	..	....	....	....	....	....	£17/9/6 (AW)
Super, Copper, Zinc and Cobalt	83	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	Trace	..	....	....	....	....	....	£19/15/0 (AW)
Super, Copper, Zinc and Molybdenum	84	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	Trace	....	....	£18/15/0 (AW)
Super and Zinc	85	do.	do.	do.	....	....	....	....	16·50	2·75	3·25	22·50	....	....	....	1·15	....	....	..	....	....	....	....	£14/7/0 (AW)
Super and Manganese	86	do.	do.	do.	....	....	....	....	14·50	2·50	2·50	19·50	....	....	....	....	....	3·80	....	....	....	....	....	£24/6/6 (AW)
Super and Molybdenum	87	do.	do.	do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	....	....	....	....	....	....	Trace	....	....	£14/12/0 (AW)
Super and Cobalt	88	do.	do.	do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	..	....	Trace	....	....	....	....	....	....	£15/12/0 (AW)
Super and Copper Ore	99	C.S.M.L.	Cuming Smith Mount Lyell F.F. Ltd.		....	....	....	....	13·00	2·25	3·75	19·00	....	....	1·25	....	....	....	....	....	....	....	....	£16/9/0 (PJW) (GW)
Super, Copper Ore and Zinc	100	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	....	....	....	£17/9/6 (PJW) (GW)
Super, Copper, Zinc, Cobalt	101	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·5	....	....	1·25	1·15	Trace	....	....	....	....	....	....	£19/15/0 (PJW) (GW)
Super, Copper, Zinc, Molybdenum	102	do.	do.	do.	....	....	..	....	12·75	2·25	3·50	18·5	....	....	1·25	1·15	....	..	..	....	....	....	....	£18/15/0 (PJW) (GW)
Super and Zinc	103	do.	do.	do.	....	....	..	....	16·50	2·75	3·25	22·50	....	....	....	1·15	....	..	....	....	....	....	....	£14/7/0 (PJW) (GW)
Super and Manganese	104	do.	do.	do.	....	....	..	....	14·50	2·50	2·50	19·50	....	....	....	....	....	3·80	....	....	....	....	....	£24/6/6 (PJW) (GW)
Super and Molybdenum	105	do.	do.	do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	..	....	..	....	..	....	Trace	....	....	£14/12/0 (PJW) (GW)
Super and Cobalt	106	do.	do.	do.	....	....	....	....	17·00	3·00	3·00	23·00	....	....	....	....	Trace	....	....	....	....	....	....	£15/12/0 (PJW) (GW)
Super and Copper Ore	126	Mt. Lyell	do.	do.	....	....	....	....	13·00	2·25	3·75	19·00	....	....	1·25	....	....	....	....	....	....	....	....	£16·9·0 (PW)
Super, Copper Ore and Zinc	127	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	....	....	....	£17/9/6 (PW)
Super and Zinc	128	do.	do.	do.	....	....	....	....	16·50	2·75	3·25	22·50	..	....	....	1·15	....	....	....	....	....	....	....	£14/7/0 (PW)
Super and Copper Ore	139	Sickle	do.	do.	....	....	....	....	13·00	2·25	3·75	19·00	....	....	1·25	....	....	..	....	....	....	....	....	£16/9/0 (PW)
Super, Copper Ore and Zinc	140	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	....	....	....	£17/9/6 (PW)
Super, Copper, Zinc, Cobalt	141	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	Trace	....	....	....	....	....	....	£19/15/0 (PW)
Super, Copper, Zinc, Molybdenum	142	do.	do.	do.	....	....	....	....	12·75	2·25	3·50	18·50	....	....	1·25	1·15	....	....	....	....	Trace	....	....	£18/15/0 (PW)
Super and Zinc	143	o.	do.	do.	....	....	....	....	16·50	2·75	3·25	22·50	....	....	....	1·15	....	....	....	....	....	.	....	£14/7/0 (PW)
Super and Manganese	144	do.	do.	do.	....	....	....	....	14·50	2·50	2·50	19·50	....	....	....	....	....	3·80	....	....	....	.	..	£24/6/6 (PW)
Super and Molybdenum	145	do.	do.	do.	....	.	..	...	17·00	3·00	3·00	23·00	....	....	....	....	....	....	....	....	Trace	.	..	£14/12/0 (PW)
Super and Cobalt	146	do.	do.	do.	....	..	.	..	17·00	3·00	3·00	23·00	....	.	....	....	Trace	....	.	..		..	.	£15/12/0 (PW)
8. Nitrogen, Phosphoric Anhydride and Minor Elements																								
Hydrangea Blueing Tonic	16	Blue Cross	Agricultural Products Co.		....	....	2·00	....	....	....	....	2·00	....	....	....	2·00	....	....	....	3·50	(S) 8·90	....	3·20	Packets
9. Nitrogen, Phosphoric Anhydride, Potash and Minor Elements																								
															PPM	PPM		PPM	PPM	PPM	PPM	PPM	PPM	
Lawn Manure	11	Blue Cross	Agricultural Products Co.		....	....	4·00	....	1·00	1·00	6·00	8·00	2·00	....	45	45	....	100	145	160	2	6	45	Packets
															PPM	PPM		PPM	PPM	PPM	PPM	PPM	PPM	
Citrus Manure	12	do.	do.	do.	....	....	4·00	....	2·00	5·00	2·00	9·00	3·00	....	250	250	....	550	750	1000	12	35	250	Packets

(PW) Perth Works. (GW) Geraldton Works. (AW) Albany Works. (PJW) Picton Junction Works.

FERTILISERS—continued

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Minor Elements									Cash price per ton at Works (W) or on Rails, Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Sol.	Citrate Sol.	Acid Sol.	Total Sol.	Sulphate	Muriate	(Cu)	(Zn)	(Co)	(Mn)	(Mg)	(Fe)	(Mo)	(B)	(Al)	
				%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
9. Nitrogen, Phosphoric Anhydride Potash and Minor Elements—*contd.*																							
Rose Bush Fertiliser	13	Blue Cross	Agricultural Products Co.		..	4·00	..	2·00	2·00	4·00	8·00	3·00	..	PPM 45	PPM 45	....	PPM 100	PPM 145	PPM 160	PPM 2	PPM 6	PPM 45	Packets
Cardex	17	do.	do.	do.	....	....	5·00	....	....	2·00	....	2·00	2·50	....	0·40	0·60	....	....	0·50	0·50	....	....	0·40	Packets
Boost Crop	18	do.	do.	do.	....	....	(4·40)	....	1·00	2·00	6·00	9·00	(3·00)	.... (as Nitrate)	PPM 90	PPM 90	....	PPM 200	PPM 275	PPM 320	PPM 4	PPM 13	PPM 90	Packets
Fertosol	19	do.	do.	do.	....	7·00	....	23·00	16·00	....	....	16·00	....	8·00	PPM 1000	PPM 100	....	PPM 120	....	PPM 500	PPM 50	PPM 50	.... (CaO)	Packets
Daphne Mix	26	Keoghs....	Wilcox Mofflin Ltd.	..	6·10	..	....	14·00	....	0·60	14·60	3·20	....	....	....	....	..	....	.. ..	....	....	....	14·50 (CaO)	Packets
Rose Food	27	do.	do.	do.	....	5·70	....	....	7·50	....	0·30	7·80	10·70	....	....	....	....	....	....	....	....	....	9·40	Packets
Lawn Grower	30	Wunda....	Higgins Hardware	....	12·00	....	....	3·25	0·50	0·50	4·25	....	11·50	0·10	0·30	....	....	....	....	....	....	....	Packets
Rose Grower ..	31	do. ...	do.	do.	.	3·80	..	. .	6·30	1·80	3·70	11·80	....	7·10	Trace	Trace	. .	Trace	Trace	Trace	Trace	Trace	Trace	Packets
Special Lawn Manure	42	Evergreen Fertiliser	Voldemars Ertners	. .	12·00	..	. .	3·25	0·50	0·50	4·25	....	11·50	0·10	0·30	. .	....	.. ..	....	....	.. .	.....	Packets
Rose Food	44	do.	do.	do.	....	(9·50)	....	....	1·95	1·10	3·50	6·55	....	6·60	0·06	0·18	....	....	....	....	....	....	....	Packets
Special Mixture "363"	77	Cresco	Cresco Fertilisers (W.A.) Ltd.	....	12·00	....	....	3·25	0·50	0·50	4·25	....	11·50	0·10	0·30	....	....	....	....	....	....	....	£36/2/4 (PW)
Tobacco Fertiliser No. 2	117	C.S.M.I..	Cuming Smith Mount Lyell F.F. Ltd.	..	3·00	..	....	7·50	1·50	1·50	10·50	15·00	..	Trace	Trace	..	....	..	....	..	..	....	£29/15/0(PJW)
Citrus Manure .	175	David Gray's	David Gay & Co. Ltd.	.	5·00	....	...	2·40	5·00	2·10	9·50	..	5·00	0·05	0·05	.	0·05	. .	0·05	0·05	0·05	3·25 (CaO)	Packets
Special Garden Fertiliser	176	do. ..	do.	do.	.. .	5·00	....	....	2·40	5·00	2·10	9·50	.. .	5·00	0·05	0·05	.	0·05	.	0·05	0·05	0·05	3·25 (CaO)	Packets
Lawn Fertiliser	177	do. .	do.	do.		5·00	. .	....	3·50	2·50	2·00	9·00	....	5·00	0·05	0·05	....	0·05	. .	0·05	0·05	0·05	3·25 (CaO)	Packets
Rose Manure .	178	do. ...	do.	do.	.. .	5·00	..	.	3·50	3·50	2·00	9·00	....	5·00	0·05	0·05	....	0·05	.. .	0·05	0·05	0·05	3·25 (CaO)	Packets
Lawn Manure . .	192	Wesfarmers	Westralian Farmers Co-op. Ltd.	.. .	(5·90)		....	5·10	2·00	4·00	11·10	.	2·30	Trace	Trace	.	Trace	Trace	Trace	Trace	Trace	Trace	Packets
Rose Manure ...	193	do. ...	do.	do.	.	(3·80)	.. .	..	6·30	1·80	3·70	11·80	....	7·10	Trace	Trace	.	Trace	Trace	Trace	Trace	Trace	Trace	Packets
Citrus Manure .	194	do. ...	do.	do.	....	(5·20)	....	..	5·10	2·00	4·00	11·10	. .	4·60	Trace	Trace	. .	Trace	Trace	Trace	Trace	Trace	Trace	Packets
Nutrifert ...	195	do.	do.	do.	...	(5·20)	....	.	5·10	2·00	4·00	11·10	....	4·60	Trace	Trace	....	Trace	Trace	Trace	Trace	Trace	Trace	Packets
Indoor Plant Food	196	do.	do.	do.	....	5·00	....	....	2·50	....	....	2·50	....	2·00	Trace	Trace	....	Trace	Trace	Trace	Trace	....	....	Packets
Rose Manure	206	Clarksons	Clarksons (W.A.) Pty. Ltd.	....	5·00	....	....	3·50	3·50	2·00	9·00	....	5·00	0·05	0·05	....	0·05	....	0·05	0·05	0·05	3·25 (CaO)	Packets
Fertiliser	207	do.	do.	do.	....	5·00	....	....	3·50	3·50	2·00	9·00	.. .	5·00	0·05	0·05	....	0·05	....	0·05	0·05	0·05	3·25 (CaO)	Packets
Rose Manure	223	Apex .	E. J. Fry Pty. Ltd.	....	....	3·00	..	5·00	2·00	6·00	13·00	....	9·00	0·03	0·015	.. .	0·02	0·05	..	0·005	0·003	.. .	£40/10/0 (PW)

Lawn Food	238	Berry's....	Berry Hardware	....	12·00	....	....	3·25	0·50	0·50	4·25	....	11·50	0·10	0·30	....	....	....	....	....	....	....	£2/15/7 per 160 lb.
Lawn Food 246	246	Dawsons	Dawson Harrison Pty. Ltd.	....	11·50	....	....	4·75	0·75	0·75	6·25	6·50	....	0·40	0·65	....	....	....	....	....	....	....	£33/10/4 (PW)
Rose Food	247	do.	do. do.	....	(6·04)	....	....	2·68	2·26	8·76	13·70	5·85	....	0·40	0·65	....	....	....	....	....	....	(CaO) 17·60	£45/0/0 (PW)
Vigoro Plant Food	248	do.	do. do.	....	(6·04)	....	....	2·68	2·26	8·76	13·70	5·85	....	0·40	0·65	....	....	....	....	....	....	(CaO) 17·60	£45/0/0 (PW)
Special Mixed Rose Manure	255	Boans	Boans Ltd.....	....	....	3·00	....	6·00	2·00	6·00	14·00	....	9·00	0·03	0·015	....	0·02	0·05	....	0·005	0·003	....	Packets
Lawn Food No. 1	268	Manning Fertiliser	H. E. Powell	....	12·00	....	....	3·25	0·50	0·50	4·25	....	11·50	0·10	0·30	....	....	....	....	....	....	....	Small quantities
Lawn Food No. 2	269	do.	do.	....	(9·50)	....	....	1·95	1·10	3·50	6·55	....	6·60	0·06	0·18	....	....	....	....	....	....	....	do.
10. Nitrogen and Minor Elements																									
Fe-Ro-Chelate	20	Blue Cross	Agricultural Products Co.	....	....	....	15·00	....	....	....	....	....	....	....	....	....	....	....	3·00	....	....	....	Packets
Nitrogeen	232	B.A.S.F.	Henry H. York & Co. Pty. Ltd.	....	(20·5)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	(CaO) 36·50	£41/0/0 (P)
Calcium Ammonium Nitrate	241	Lanes	Lanes (W.A.) Pty. Ltd.	....	(20·5)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	(CaO) 33·40	£41/0/0 (P)
11. Trace Elements																									
Minorels	21	Blue Cross	Agricultural Products Co.	....	....	....	....	....	....	....	....	....	....	1·00	1·00	(CaO) 9·00	2·25	3·30	4·00	0·05	0·15	1·00	Packets
Copper Sulphate	187	David Gray's	David Gray & Co. Ltd.	....	....	....	....	....	....	....	....	....	....	39·50	....	....	....	....	....	....	....	....	Packets
Tracels	216	Dawn	Dawn Fertilisers	....	....	....	....	....	....	....	....	....	....	0·90	0·20	....	2·00	2·50	37·60	0·20	0·50	....	Packets
Ess-Min-El	244	Lanes	Lanes (W.A.) Pty. Ltd.	....	....	....	....	....	....	....	....	....	....	1·32	0·25	(Ca) 1·32	1·97	5·21	4·83	0·198	·0057	(S) 5·00	£118/0/0 (P)
12. Liquid Fertilisers																									
Liquid Fertiliser	22	Blue Cross	Agricultural Products Co.	....	....	....	6·50	5·00	....	....	5·00	....	(as Nitrate) 3·00	....	....	....	....	....	....	....	....	....	Bottles
Liquid Manure	28	Keogh's	Wilcox Mofflin Ltd.	....	1·70	....	....	3·70	0·10	....	3·80	2·00	....	....	....	....	....	....	....	....	....	(CaO) 1·25	Bottles
Do.	154	Aquasol	Horticultural Industries	....	....	....	20·00	12·00	....	....	12·00	16·00	....	....	....	....	....	0·30	....	....	(CaO) 1·00	....	Bottles
Liquid Fertiliser	179	David Gray's	David Gray & Co. Ltd.	(9·00)	....	....	....	13·10	....	....	13·10	....	(as nitrate) 4·00	50 PPM	50 PPM	....	50 PPM	....	....	....	....	....	Bottles
Liquid Manure	197	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	10·00	....	....	5·00	....	....	5·00	....	(as nitrate) 4·50	Trace	Trace	....	Trace	Trace	Trace	Trace	....	....	Bottles
Do.	205	Watkins	The J. R. Watkins Co.	....	....	....	22·00	12·00	....	....	12·00	14·00	....	Trace	Trace	....	Trace	....	Trace	Trace	Trace	....	Bottles
Liquid Fertiliser and Plant Food	242	Lanes	Lanes (W.A.) Pty. Ltd.	....	....	....	8·60	8·60	....	....	8·60	4·00	....	0·25	0·12	....	0·25	0·20	0·40	0·077	0·50	....	£1/2/6 gal. (P)
Water Soluble Liquid Manure	243	do.	do. do.	....	....	....	24·00	12·00	....	....	12·00	....	16·00	....	....	....	....	....	....	....	....	....	Packets
Concentrate Fertiliser	250	Spring	F. H. Faulding & Co. Ltd.	....	....	....	7·50	5·00	....	....	5·00	....	4·00	....	....	....	....	....	....	....	....	..	Bottles

(PW) Perth Works. (GW) Geraldton Works. (AW) Albany Works. (PJW) Picton Junction Works.

FERTILISERS—continued

Name of Fertiliser	Reg. No.	Registered Brand	By Whom Registered	Nitrogen (N) as				Phosphoric Anhydride (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails at Perth (P)
				Nitrate	Ammonia	Blood and Bone	Urea	Water Soluble	Citrate Soluble	Acid Soluble	Total Soluble	Sulphate	Muriate	
				%	%	%	%	%	%	%	%	%	%	
B. ORGANIC FERTILISER														
1. Blood and Bone												Fine Material		
Blood and Bone Fertiliser	1	Blue Cross	Agricultural Products Co.	....	....	5·00	....	....	2·00	7·00	9·00	a 100 b 55		Packets
Blood and Bone	34	Wunda	Higgins Hardware	....	....	5·00	....	....	2·00	7·15	9·15	a 100 b 55		Packets
Do.	41	Evergreen Fertilisers	Voldemars Ertners	....	....	5·00	....	....	2·00	7·15	9·15	a 100 b 55		Packets
Do.	49	Freecorns....	Freecorns	....	....	5·00	....	....	2·00	7·15	9·15	a 100 b 55		Packets
Do.	55	Wyndham	Wyndham Meat Works	....	....	6·00	....	....	5·50	9·50	15·00	a 100 b 55		£36/3/6 (P)
Do.	56	N.Z.	Burridge & Warren Pty. Ltd.	....	....	7·50	....	....	8·70	1·30	10·00	a 100 b 55		£44/0/0 (P)
Blood and Bone Fertiliser	57	Sayer	do. do. do.	....	....	4·25	....	....	8·85	9·90	18·75	a 100 b 55		£42/0/0 (P)
Blood and Bone Manure	155	Kitchens	J. Kitchen & Sons Pty. Ltd.	....	....	6·80	....	....	9·00	5·00	14·00	a 100 b 55		£30/0/0 F.O.B. £47/0/0 (P)
Blood and Bone	156	Best	W. J. Pascoe & Sons	....	....	6·00	....	....	4·00	11·00	15·00	a 100 b 55		Packets
Do.	164	Symonds	E. Symonds	....	....	5·25	....	....	2·50	6·50	9·00	a 100 b 65		Packets
Do.	174	David Gray's	David Gray & Co. Ltd.	....	....	5·00	....	....	2·00	8·00	10·00	a 100 b 55		£34/0/0 (P)
Do.	190	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	5·00	....	....	2·00	7·15	9·15	a 100 b 55		£36/0/0 (P)
Do.	208	Dawn	Dawn Fertilisers	....	....	5·00	....	....	2·00	8·00	10·00	a 100 b 55		Packets
Do.	218	Mars	Fergusons By-products Pty. Ltd.	....	....	6·00	....	....	3·50	11·50	15·00	a 100 b 55		£32/0/0 (W)
Do.	221	Apex	E. J. Fry Pty. Ltd.	....	....	6·00	....	....	4·00	11·00	15·00	a 100 b 55		£41/5/0 (W)
Do.	225	Sound	Cockburn Sound Fertilisers	....	....	5·25	....	....	2·50	6·50	9·00	a 100 b 65		£32/0/0 (W)
Do.	249	Smorgan	Norman Smorgan & Sons Pty. Ltd.	....	....	5·00	....	....	4·00	10·00	14·00	a 100 b 55		£40/0/0 (P)
Do.	254	Boans	Boans Ltd.	....	....	6·00	....	....	4·00	11·00	15·00	a 100 b 55		Packets
Do.	262	P.P.	Picton Produce Pty. Ltd.	....	....	5·00	....	....	5·00	10·00	15·00	a 100 b 55		£36/0/0 (PJW)
Do.	267	Manning Fertilisers	H. E. Powell	....	....	5·00	....	....	2·00	7·15	9·15	a 100 b 55		Packets
Do.	275	T.B. & S. in diamond	Thomas Borthwick & Son Ltd.	....	....	5·75	....	....	6·75	5·25	12·00	a 100 b 55		£30/0/0 (AW)
2. Animal Fertilisers														
Animal Fertiliser	2	Blue Cross	Agricultural Products Co.	....	....	3·50	....	....	3·00	9·00	12·00	....	....	Packets
Bone Dust	3	do.	do. do. do.	....	....	3·00	....	....	2·00	7·00	9·00	....	....	Packets
Animal Fertiliser	220	A.N.A. Surprise	E. J. Fry Pty. Ltd.	....	....	5·00	....	....	4·00	10·00	14·00	....	....	£47/10/0 (P)
Meat Meal Fertiliser	245	Dawsons	Dawson Harrison Pty. Ltd.	....	....	4·59	....	0·14	6·56	9·60	16·30	....	....	£32/10/0 (W)
3. Blood Meal Fertilisers														
Dried Blood	191	Wesfarmers	Westralian Farmers Co-op. Ltd.	....	....	12·00	....	....	....	....	....	....	....	£30/0/0 (P)

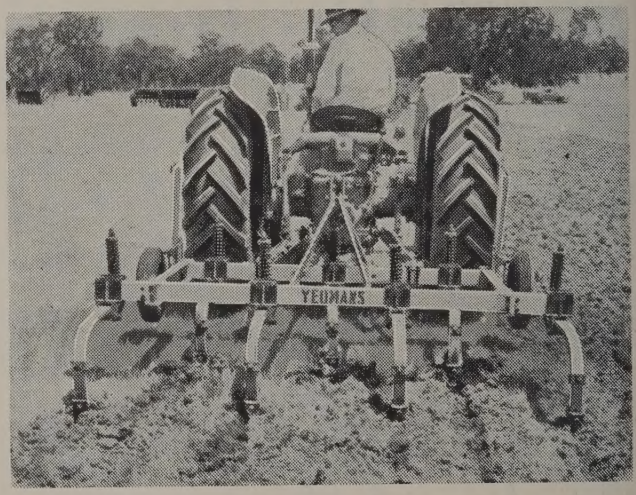
4. Fish Fertilisers														
Special Fish Manure	4	Blue Cross	Agricultural Products Co.	....	....	3·50	....	....	....	....	7·50	....	....	Packets
Fish and Bone	50	Freecorns	Freecorns	....	....	3·50	....	....	3·00	4·00	7·00	....	....	Packets
Craymeal	226	Sound	Cockburn Sound Fertilisers	....	....	5·50	....	....	....	....	....	....	....	£30/0/0 (W)
Fish Fertiliser	227	do.	do. do. do.	....	....	4·50	....	....	2·00	6·00	8·00	....	....	£28/0/0 (W)
C. AGRICULTURAL LIME														
Garden Lime	23	Blue Cross	Agricultural Products Co.	Calcium Carbonate 40%			Neutralising Value 75%			....	....	....	....	Packets
Do.	40	Wunda	Higgins Hardware	Neutralising Value 85%			....	....	....	....	....	....	....	Packets
Do.	163	Best	W. J. Pascoe & Son Ltd.	Neutralising Value 75%			....	....	....	....	....	....	....	Packets
Do.	188	David Gray's	David Gray & Co. Ltd.	Neutralising Value 75%			....	....	....	....	....	....	....	Packets
Agricultural Lime	204	Wesfarmers	Westralian Farmers Co-op. Ltd.	Neutralising Value 95%			....	....	....	....	....	....	....	Packets
Garden Lime	217	Dawn	Dawn Fertilisers	Neutralising Value 75%			....	....	....	....	....	....	....	Packets
Hydrated Lime	219	Swan	Swan Portland Cement Ltd.	Neutralising Value 93%			....	....	....	....	....	....	....	£13/0/0 (W)
						(CaO)								£13/10/0 (P)
Hydro Lime	229	Hydro	Perth Modelling Works Pty. Ltd.	....	....	70·20	Neutralising Value 85%			....	....	....	....	£13/10/0 (P)
Garden Lime	261	Boans	Boans Ltd.	Neutralising Value 75%			....	....	....	....	....	....	....	Packets

(PW) Perth Works. (GW) Geraldton Works. (AW) Albany Works . (PJW) Picton Junction Works.

COMPACTION KILLS YOUR SOIL LIFE

JUST AS SURELY AS A 10-YEAR DROUGHT

This "life"—from the smallest single cell Bacteria with a life cycle of 20 minutes to the largest earth worm with a life of at least 14 years—disappears completely when denied the 3 essentials for soil life—AIR: Moisture: Warmth. Soil workers die and the fertility cycle of the soil has ceased.



The Remedy is Simple and Economical with Intelligent Use of

The GRAHAM CHISEL PLOW

Reaching down into this dying soil to a depth of 1½ in. to 2 in. just below the root zone, the Graham produces complete and rapid aeration, allowing full absorption of moisture and ensuring a terrific re-build up of the soil "life."

WHEREVER THE GRAHAM HAS BEEN . . . . Pastures show vigorous and healthy growth . . . . Crops are well stooled, taller and a deeper green . . . . "Life" has returned to once sick and dying soil . . . . Rain has been held and stored where it has fallen . . . . Run-off has ceased . . . . Long dried-out soaks are filling once again.

The GRAHAM is more than a Plow . . . . It is the symbol of prosperity to the man on the land who uses it correctly. This is because the Graham, and only the Graham, was designed with a correct scientific regard for the requirements of soil development and water conservation.

You owe it to your future to invest in a GRAHAM

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